NATICK LABORATORIES PROMPT WIDE INTEREST IN ENZYMATIC PROCESS

Page 16

ARMY RESEARCH AND DEVELOPMENT

July–August 1974

SPEAKING ON . . .

International Development & Standardization

In the U.S. Army Materiel Command

Beginning in mid-September, a briefing team composed of personnel representing the Office of the Chief of Research, Development and Acquisition and the U.S. Army Materiel Command will visit major commands and laboratories concerned with AMC International Programs to make a presentation on this subject. A condensed version of information follows.

United States participation in numerous international research, development and military materiel standardization programs, including serving as a point of contact with higher headquarters and foreign governments, is a managerial responsibility of the U.S. Army Materiel Command.

The network which supports the AMC in the exchange of scientific and technical information relative to these multilateral and bilateral programs is organized for almost worldwide operations. Cooperation involved can impact upon virtually all segments of the life-cycle management model for many of the Army weapon systems.

Involved in this massive effort are in excess of 200 groups and individuals, more than 1,000 written agreements (about 175 on data exchange), and roughly $6 million annually spent overseas on R&D.

Agreements apply to small arms projects, large-scale air defense weapons evaluations and development, ammunition, bridges, guns, armor, camouflage, and fuel-cell projects. Cooperation takes many forms, including simple technology, exchange, collaborative and exploratory techniques, and jointly funded and managed developments.

AMC's international research, development, and standardization headquarters element is small and controls few resources, but it draws support from other Army projects and organizations.

Direct interface is assured with the Office of the Chief of Research, Development and Acquisition, other Department of Army (DA) staff agencies, and AMC subordinate commands, laboratories and activities. Coordination is effected also with the appropriate foreign embassy or representatives associated with the particular program involved.

AMC participates in 11 major international programs, as follows:

Mutual Weapons Development Data Exchange Program (MWDDEP) and Defense Development Exchange Program (DDEP). MWDDEP is a program under which participating countries exchange technical and scientific information with the U.S. The DDEP is a similar program conducted between countries of the Far East and the U.S.

Master agreements, which permit the exchange of imformation and outline the conditions and procedures governing this exchange, are established between the U.S. and other countries participating in the MWDDEP or DDEP. Annexes to the master agreement give details pertinent to an exchange of information in specific fields.

Data Exchange Agreement (DEA) annexes may originate in any participating country, and may be initiated at Department of Defense level, at agency/organization level, or at echelons between them. The U.S. Army assigns technical monitorship or supervision to the appropriate agency or command on an annex-by-annex basis.

Agencies/commands exercising technical monitorship or supervision generally are tasked to draft the annex for review by the Army Materiel Command, the Department of the Army, and the participating countries. The monitoring agency also establishes local procedures to discharge responsibilities, including assignment of a specific individual to serve as project or technical project officer.

In addition to technology or data exchange, the mutual loan of equipment or materiel pertinent to a DEA is authorized for test and evaluation purposes. All costs incident to the DEA loan, including transportation, spare parts and rehabilitation, normally will be borne by the country requesting equipment.

The requesting AMC subordinate command, laboratory or agency bears all costs incident to loan testing and evaluations of foreign equipment or materiel.

Cooperative R&D Program. In accordance with AR 70-41, Cooperative R&D is applied to R&D activities ranging from the exchange of technical information to systems development in which the U.S. participates with one or more other nations. They include:

- Data Exchange, whereby the U.S. exchanges technical and scientific information with participating countries.
- Allocated Development, whereby the U.S. and one or more participants define an R&D problem in terms of tasks; allocate to the separate participants responsibility for accomplishment of the tasks; complete the tasks, using national resources; and share outcomes of the tasks. Allocated development is used most frequently for research or exploratory development.
- Adaptive Development, whereby the U.S. obtains for evaluation and possible adoption materiel that has been or is being developed by one or more other participants. Adaptive development may correspond to advanced, engineering, or operational systems development and may culminate in a decision to accept the foreign-developed materiel as meeting U.S. requirements.
- Joint Development, whereby the U.S. and one or more participants agree upon a materiel requirement; share responsibility for funding and managerial or operational aspects of development; evaluate for possible adoption the outcome of the development. Joint development may correspond to exploratory, advanced, engineering or operational systems development, and may culminate in a decision to accept jointly developed materiel as meeting U.S. requirements.
- Interdependent Development, whereby participants agree upon a materiel requirement; assign to one participant all development responsibility, including funding, and other participants forego development; and evaluate for possible adoption the outcome of the development.

Interdependent development may correspond to exploratory, advanced engineering, or operational systems development, and may culminate in a decision to accept foreign-developed materiel as meeting U.S. requirements.

Interdependent R&D has been the subject of recent 4-power discussions between the United States, United Kingdom, Federal Republic of Germany and France. Rather than joint development under the conventional cooperative R&D project where costs, data and rights are shared, interdependency provides for tradeoffs of unilateral development by one nation with that of others having the same or similar requirements.

Test models may be obtained for evaluation by purchase or loan. If adopted, the requiring nations negotiate with the developing nation for purchase of produced items or a technical data package and rights thereto for their own production.

U.S./Canadian Defense Development Sharing Programs. A Memorandum of Understanding (MOU) in the field of cooperative development between the U.S. Department of Defense (DoD) and the Canadian Department of Defense Production (CDDP) was signed Nov. 21, 1963. The MOU superseded three 1960 agreements between Canada and the U.S. Army, Navy and Air Force.

Under the 1960 agreements, several development-sharing projects were initiated in the 1960-62 time-frame—some with 100 percent Canadian funding. A significant difference is that the 1963 MOU requires the U.S. to fund at least 25 percent of the development cost in Canada (Canada may pay 100 percent for a component of a system which otherwise is funded by the U.S.).

Except for the cited MOU, the DoD uses agreements, written up much like an MOU. A project agreement sets forth arrangements between the U.S., as represented by the Department of the Army, and Canada, as represented by the Canadian Department of Industry, Trade and Commerce (CDITC), acting on behalf of the CDDP for a cooperative R&D project under the Defense Development Sharing Program.

The project agreement is undertaken within the framework, terms and conditions of the MOU in cooperative development between the U.S. Department of Defense and project agreements with the Canadian

(Continued on page 24)

ABOUT THE COVER . . .

The U.S. Army Natick (MA) Laboratories are shown in this aerial view. Backed by more than 31 years of prideful achievements in research, development, test and engineering to provide for the effectiveness, protection and physical well-being of the soldier in all battlefield environments, the NLABS have been much in the public limelight during recent weeks. A Senate subcommittee held three days of hearings to probe into important possibilities of an exciting new technology. *See page 16 for feature article.*

Editor . . . . . **Clarence T. Smith**
Associate Editor . **George J. Makuta**
Editorial Assistant **Harvey Bleicher**
Staff Assistants . . **Ashton Mossburg**
Mrs. Thelma Heisler

Published bimonthly by the Plans and Programs Division of the Research, Development and Engineering Directorate, HQ U.S. Army Materiel Command, Alexandria, VA, in coordination with the Technical and Industrial Liaison Team, Office of the Chief of Research, Development and Acquisition, HQ Department of the Army, to serve all elements of the U.S. Army R&D community.

Grateful acknowledgement is made for the valuable assistance of Information Offices within the Army Materiel Command, Office of the Surgeon General, Office of the Chief of Engineers, Army Training and Doctrine Command, Army Forces Command, Office of the Assistant Chief of Staff for Force Development, Office of the Assistant Chief of Staff for Communications-Electronics, Computer Systems Command, and miscellaneous related activities. Use of funds for printing of this publication has been approved by the Department of the Army, Jan. 1, 1974.

Purpose: To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among Army R&D activities; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

Picture Credits: Unless otherwise indicated, all photographs are by the U.S. Army.

Submission of Material: All articles submitted for publication must be channeled through the technical liaison or public information officer at installation or command level.

By-lined Articles: Primary responsibility for opinions of by-lined authors rests with them; their views do not necessarily reflect the official policy or position of the Department of the Army.

ARMY RESEARCH AND DEVELOPMENT

Vol. 15, No. 4 **July–August 1974**

FEATURES

DEPARTMENTS

DISTRIBUTION is based on requirements submitted on DA Form 12-5. Army agency requirements must be mailed to the U.S. Army AG Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220.

Distribution on an individual name basis is restricted to members of the U.S. Army Atomic Energy and R&D Officer Programs and to R&D Mobilization Designees. Otherwise, distribution is made only to the Army installation, office or organizational element to which the requester is assigned.

CHANGES OF ADDRESS for R&D and AE Officer Program enrollees should be addressed to U.S. Army Materiel Command, ATTN: AMCRD-PS-NM, 5001 Eisenhower Ave., Alexandria, VA 22333. R&D Mobilization Designees should report changes of address to Commanding General, USARCPAC, ATTN: AGUZ-CMD-MC, P.O. Box 12467, Olivette Branch, St. Louis, MO 63132.

OTHER GOVERNMENT AGENCIES' requirements should be submitted directly to: AMCRD-PS-NM, 5001 Eisenhower Ave., Alexandria, VA 22333.

ALL NON-U.S. GOVERNMENT agencies, firms and organizations must obtain this publication through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Single copies 75 cents. Subscription rates (6 issues annually) are: Domestic, APO and FPO addresses, $4.45; Foreign $5.60.

Selective Scanner . . .

MERDC-Picatinny Seek Mobile Pipe-Winding Plan

PROPOSED mobile continuous pipe-winding plant (artist's concept). MERDC and Picatinny are collaborating agencies.

Fabrication of o continuous pipeline in the field is the objective of a developmental effort by the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, VA, assisted by Picatinny Arsenal, Dover, NJ.

Discussions between the MERDC and Feltman Research Laborotory personnel at Picatinny led to the concept of continuous fabrication and laying of a lightweight fibrous glass composite pipe cured by high-intensity ultraviolet energy. John Nardone ond Charles Yearwood, materiols engineers at Picotinny, are working with the MERDC in the developmentol program.

The requirement for this new capability was roised by the high cost of combat area pipeline systems for transporting military fuels from the tanker discharge point to distant storage areos. The pipelines currently are constructed by welding lengths of high-pressure steel pipe. Logistics of handling heovy, bulky pipe led to the continuous field fobricotion idea.

Reseorch into the current stote-of-the-ort of pipe making, a technology survey of high-pressure composite pipe (1,000 pounds per square inch working pressure), ond feasibility studies preceded successful demonstrotion of o laboratory scole model for wropping continuous lightweight pipe.

A prototype unit will be designed and built following further evaluotion of the loborotory model. Mounted on o flotbed troiler truck, the unit will provide o field mobile, self-contoined production unit for combot requirements.

Boeing Files for Certification of HLH Model 301

An applicotion for commerciol certification of the U.S. Army Heovy Lift Helicopter (HLH) Model 301, commercial version, with a reported verticol lift capobility "exceeding 35 tons," is being filed by the Boeing Vertol Co. The Army version is scheduled for its initiol flight test in August 1975.

The Boeing onnouncement claimed the Model 301 is the "greatest lifter of ony helicopter in the world, either flying or under development." Commercial certificotion, it wos stated, "will be benficiol to both industry ond government by lowering unit costs for eoch of them." The objective olso is to "take moximum odvontoge of porollel engineering and test octivities" required for Army certificotion.

NLABS Publish Guide to Heraldric Color Coding

Simplificotion of color coding for heroldric yorns used by the Military Deportments for shoulder patches, the trim on flogs ond thousands of other items—a reduction from 161 to 99 shades—hos been onnounced by the Army Notick (MA) Lobs.

Acting in response to the Army Institute of Heroldry ond the individual services, the NLABS hove published a brochure titled "Department of Defense Color Cord of Official Stondord Shades for Heraldric Yorns for Embroidery and Ribbons, 1974."

The new guide carries yorn somples with their present nome and identifying cable number, including cross references to show names the shade may have been called previously. For example, Air Force Yellow is the single name for what formerly were known as Spanish Yellow, Green Gold and Air Force Yellow—actuolly the same.

HDL Travel Team Tends Telemetry Van

Constant travel is a way of life for a 9-man Harry Diamond Laborotories teom of electronics experts who last year participated in 289 test days at 14 different proving grounds ond journeyed over 511,000 man-miles.

Using four completely equipped mobile vans, featuring the latest in telemetry and data acquisition systems, the team provides general assistance to the project representotive as required. Project engineers are provided the advanced instrumentotion needed to process field data.

The dota station contains recorders, tunable discriminotors, signal conditioners, counters, spectrum analyzers and various other devices to reduce the product of 21 telemetry and field dota channels into standard analog format.

ARMCOM Adopts GFM Radial Forging Machine

Gun barrel blanks can be preformed, rifled and chambered in one 5-minute operation by a new GFM Rodial Forging Machine at the U.S. Army Armament Command (ARMCOM), Rock Island Arsenal, IL.

Believed the first of its kind in use within a U.S. Government agency, the device was built in Steyer, Austria. Capable also of simultaneously performing a limited amount of outside contouring, the GFM minimizes the processing waste of expensive alloys required for high-performance gun barrels.

High temperatures generoted during the firing of new small-caliber weapons are a major problem in the erosion of gun barrels. Although high-temperoture-resistant alloys have been developed, design engineers say their opplicotion is limited because fobricability ond refractory behovior ore usuolly inversely related.

Authorized under the U.S. Army Materiel Commond's Monufocturing Methods ond Technology Progrom, personnel at Rock Island's Rodman Laborotories sought new and efficient metol-shoping procedures for the fobricotion of contemporary ond advanced gun barrel materiols. Selection of the GFM followed extensive evaluations of numerous processes.

The oversize rifling-chombering mandrel olso produces finely finished bore surfaces, eliminating the need to electropolish gun barrels prior to chromium ploting.

The ARMCOM onnouncement soid test results hove demonstrated that it offers o cost-effective monufacturing procedure for temporory ond improved gun borrel moteriols. Watervliet (NY) Arsenol and severol commerciol organizotions have expressed interest in the mochine.

HDL Slates Fluidics Symposium at NOL

Fifteen yeors after the Harry Diomond Loborotories onnounced fluidics as o new technology of control mechanisms having vast potentiol opplicotions, the first internotionol Fluidic Stote-of-the-Art Symposium is expected to drow 200 to 300 porticiponts.

In onnouncing thot the symposium will be held Sept. 30 through Oct. 4 at the U.S. Novol Ordnance Laborotory, White Ook, MD, the Horry Diomond Loborotories exploined thot the change of planned locotion wos necessary becouse of construction moterial delays in HDL's new complex ot Adelphi, MD.

Experts from oll over the world will exomine the technology bose and the improvements thot are finding applications in the growing fluidics industry.

Technical presentotions ore expected to verify high reliability cloims for fluidic control systems with power ronges from one miliwott to mony thousonds of watts; olso, on updote on predicting choracteristics from the geometry of the fluidic device, ond a discussion of anolog circuits similor to electronic circuits.

Interested porties moy contoct Joseph Kirshner for odditionol detoils, in writing or by calling Autovon 292-2133.

WSMR Completes First of 60 Quanah Test Firings

Launching of the first of 60 scheduled test firings of the U.S. Army's new meteorological research rocket, the Quanah, was announced recently by White Sands (NM) Missile Range in what was described as a "diagnostic" mission.

The stratospheric measurement payload was released at 255,000 feet (more than 48 miles) altitude and the mission was pronounced completely successful following recovery of the instrumentation returned to earth.

Developed jointly by the U.S. Army, NASA, and Canada, the Quanah is designed to function in any climate during all weather conditions. Subsequent launches will carry various research payloads. The 9-foot rocket weighs about 112 pounds.

Educational TV Gets Favorable Responses at AICS

A new concept in educational television (ETV) is apparently receiving favorable responses from both students and faculty at the Army Intelligence Center & School, Fort Huachuca, AZ.

Termed modular instruction, the system provides video taped instruction on specific points of a major topic, thus reducing the need of showing full-length films or tapes. Tape presentations are followed by discussions and question and answer periods.

ETV transmits over a 12-channel closed circuit system to 99 classrooms, school offices, orderly rooms and dayrooms. A command channel also provides information to post personnel.

Instructors say that ETV permits instant analysis of classroom comprehension of a particular point. Students also approve of the concept since it helps them digest long blocks of formal training which was previously presented in uninterrupted format.

MICOM Conducts Laser-Guided Night-Firing Tests

Laser guidance of a Hornet 7-inch air-to-surface missile resulted recently in a direct impact on a tank more than a mile away in a recent "precision designated" night firing operation at Redstone Arsenal, AL.

The prototype night vision device used in the test firing is under development by Texas Instruments Inc. The laser illuminator was ground-based and the designation was accomplished manually with the NV device.

The Hornet missile and the Army laser seeker were developed and provided under contract by the Missile Systems Division of Rockwell International Corp. The test was part of MICOM's continuing program to investigate and accumulate missile terminal homing guidance technology data.

WSMR Launches Its Largest Balloon for LACATE

Successful launch and flight of a 45.3 million cubic foot balloon, believed the second largest ever flown, as a multi-government agency-industry experiment linked to NASA's projected 1978 Nimbus G satellite launching, was announced recently at White Sands Missile Range, NM.

Objective of the Lower Atmospheric Composition and Temperature Experiment (LACATE) was to gather data for studies of the photochemistry of the stratosphere in the lower altitudes where high-flying jet aircraft operate.

Measuring 600 feet in height—over one-tenth of a mile—the balloon reached an altitude of 134,000 feet (more than 25 miles) during a 9½-hour flight. It was the largest balloon ever flown successfully at WSMR.

Scientists assigned to the project hope to determine if jet engine exhausts at such altitudes can react with natural gases to thin out the ozone layer in the atmosphere that shields Earth from the sun's potentially harmful ultra-violet rays.

Dr. Jim Russell, project scientist at NASA's Langley Research Center, and Dr. John Gille, National Center for Atmospheric Research, believe that the radiometer obtained good radiance profile in the stratosphere. Data collected will be evaluated to determine its potential applications.

SAM-D Firings Respond to Objectives at WSMR

Ten SAM-D missile firings to verify the control system and structural design prior to a fully guided series of tests, programed to begin in October, are scheduled for completion in July at White Sands Missile Range, NM.

Six of the firings had been completed at press time for this edition of the *Army R&D Newsmagazine*. SAM-D Project Manager BG Charles F. Means termed the results highly successful. He said the sixth test, with the missile guided by an onboard programer, flew a low to intermediate altitude trajectory and responded 100 percent to command maneuvers.

One of the major objectives of this test was to evaluate the dynamic effects of the missile plume on radio frequency signals transmitted from the missile to a prototype radar.

The highly mobile, all-weather SAM-D system is being developed for use against high-performance aircraft to replace the Nike Hercules and the Hawk systems.

Raytheon Co. is the SAM-D prime contractor and Martin Marietta Aerospace Corp. is the principal subcontractor. Thiokol Chemical Corp. is subcontractor for the propulsion system.

USACCL Transfers Functions, Personnel to MERDC

Many of the functions and personnel of the U.S. Army Coating and Chemical Laboratory will be relocated from Aberdeen Proving Ground, MD, to the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, VA.

Discontinuance of the USACCL by June 30 was announced in February as part of a widespread realignment and curtailment of Army field installations.

More than 50 percent (27 civilian and 5 military) of the laboratory's personnel have been offered positions at Fort Belvoir. They will comprise a Fuels, Lubricants and Coatings Division in a new Petroleum and Materials Department.

The FLC Division will continue to function as a lead laboratory for mobile equipment for air pollution control and as manager of the Army Materiel Command program in fuels, lubricants, hydraulic fluids and preservative surfacings. The USACCL was placed under MERDC management control in the fall of 1972.

U.S., FRG Conduct Meteorological Tests at WSMR

Comparative techniques for measuring upper atmospheric density and winds are being utilized in an experimental test program conducted by United States and West Germany personnel at White Sands (NM) Missile Range.

Participants include Dr. Hans Widdel and Gerhard Rose, Max Planck Institute for Aeronomy, Lindau, W. Gy., and Robert Olsen and Bruce Kennedy, Atmospheric Sciences Lab., WSMR.

During three tests, 19 meteorological rockets will be launched at close intervals to insure that various sensors will measure desired data under similar atmospheric conditions.

One German-developed technique permits measurements of atmospheric parameters between 70 and 95 kilometers altitude by observing fall characteristics and behavior of foil chaff released from the rockets. Findings will be compared to density and wind data from a falling sphere deployed from a rocket.

One area of prime interest to the research team is the enhanced absorption of radio signals as they transverse the D-region of the ionosphere during winter months. Identified as the winter absorption anomaly, this phenomenon is believed to originate in the meteorology of the upper atmosphere.

Dr. Hoyt Lemons of the Army R&D Group, Europe, served as liaison officer and coordinator during negotiations between WSMR Atmospheric Sciences Lab and the Max Planck Institute.

HDL Unveils New Rapid Gelling Epoxy Resin

A new rapid-gelling epoxy resin, capable of curing up to five times faster than some standard types currently in use, has been synthesized successfully by the U.S. Army's Harry Diamond Laboratories (HDL), Washington, DC.

Identified as diglycidyl ether of 4-methyloresorcinol (DGEMER), the substance has potential industrial applications as adhesives, protective coatings, and for heat-sensitive electrical components.

Useful in expediting production processes, the resin requires no special accelerators, and can be cured with amines, anhydrides, and other standard epoxy hardners. Numerous applications, formulations and evaluations are being studied.

R&D News . . .

WSMR Assembles Most Precise Meteorological Satellite Weather Pictures

White Sands (NM) Missile Range announced June 3 the acquisition of what are believed the first of the most highly resolved weather pictures ever taken from outer space.

A synchronous meteorological satellite, launched by NASA from Kennedy Space Center, May 17, sends signals to several ground stations. The station at the missile range has a laser recorder and other special equipment which assembles data at 30-minute intervals into pictures with a resolution to a half-mile.

Currently, the announcement stated, the WSMR site is the only place in the world operationally capable of recording pictures to such a degree of resolution. Other sites can record to a resolution of about four miles.

The significance is that if a cloud or other visible phenomena of a weather system is a half-mile or more wide, but less than four miles, it will be seen in WSMR photographs but not elsewhere.

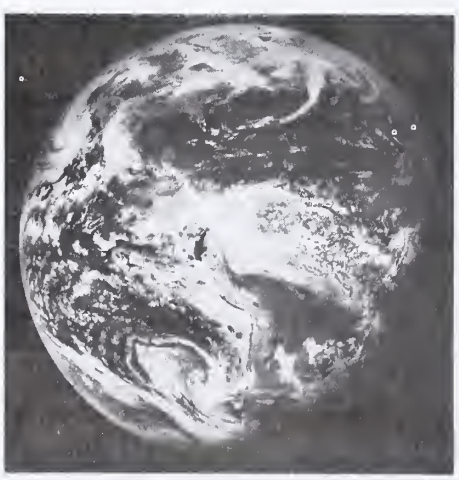
Before the synchronous satellite advent, similar conventional satellites sent data that resulted in resolution to 30 miles.

Stationed over the equator at 22,300 miles altitude, the satellite is the first of an international network of synchronous meteorological satellites expected to provide weather information of unprecendented scope. Russia, France and Japan also are scheduled to launch the weather satellites, and the United States will launch at least one more.

The space vehicle can be moved along the equator to "parking spaces" over the Atlantic and Pacific as well as over Brazil. Since the vehicle's orbit is synchronized with the earth's rotation, the satellite will remain in a fixed position relationship with ground sites unless commanded to do otherwise.

The satellite's purpose is to meet National Operational Environmental Satellite System (NOESS) requirements for toting a large, visible and infrared spin scan radiometer to take full-view pictures of the earth's surface. NOESS is operated by the National Environmental Satellite Service.

Launch difficulties delayed transmission of signals to the WSMR ground station, which is operated by the Atmospheric Sciences Laboratory (ASL) of the Army Electronics Command.



SAMPLE of the highly resolved weather pictures received at WSMR from a satellite stationed 22,300 miles above the equator.

FIBERGLASS COVERING over the tracking instrument resembles a giant golf ball in this view. Inside, a 25-foot dish is focused on the synchroneous meteorological satellite.

Dr. Willis Webb, chief of the Meteorological Satellite Technical area at ASL and a lecturer at the University of Texas at El Paso, conducted a press briefing May 23.

Spokesmen for NASA, L. Maurice Clelland, assistant manager at the NASA-WSMR test facility, and Don Fordyce, project manager for advanced weather satellite at Goddard Space Flight Center, MD, answered questions on their agency's role in the project.

Newsmen also visited the ground station and were briefed by William Vechione, senior electronics engineer. They witnessed processing of the satellite's pictures and saw how a closed-circuit television system shows weather pictures to missile range scientists working on other projects.

The satellite collects environmental data from up to 10,000 sensing platforms at remote and sometimes unmanned surface sites. Data is released to regional forecasting and warning stations. Prime focus is the area between 60 degrees south and 60 degrees north latitude.

The half-hour interval for sending pictures of many locations is an improvement over the present 3-hour sending interval for single locales. The nearly 600-pound satellite scans 1,821 west to east-oriented regions every 18 minutes. Another 12 minutes are required to recycle the operation.

A radar dish at WSMR receives radio signals from the satellite and feeds them into a computer for conversion into digital data. The data modulates a laser which burns whatever the satellite sensors record into scan lines on film wrapped around a roller that revolves 10 times faster than the satellite spins to accommodate multisensor readings.

The process limits the laser to burning only to the degree that sensors record light intensity. A picture is ready in three minutes.

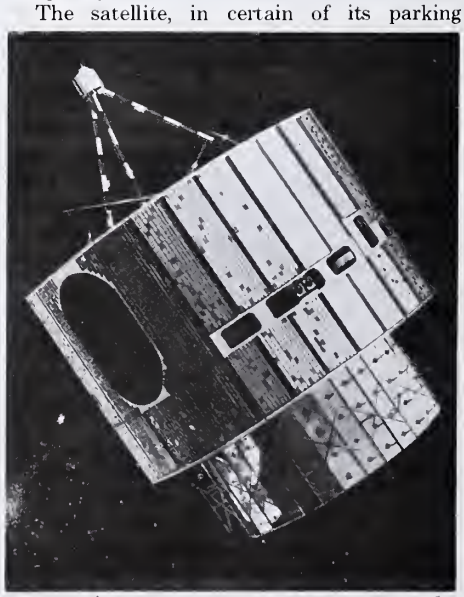
The best forecasting improvement focuses on providing the field commander with trafficability, weather and other atmospheric data in areas distant from his, as well as detailed data for his own location so he can better deploy and use his weaponry and forces.

Instead of trying to sift synoptic data of hundred-mile scales for information on smaller locations within the whole, Army scientists will be able to obtain information on specific half-mile square areas.

Satellite data will be compacted and stored on 22-inch square sheets of film. For display, ASL scientists will use a magnetic drum with a capacity for 200 composite pictures of earth to show an animation of four days weather in a few minutes.

WSMR researchers said the film will resemble time lapse photography of clouds the public sees on television weather shows, but the SMS-A data will be of better scientific quality because of improved resolution and frequency.

The satellite, in certain of its parking



SYNCHRONOUS METEOROLOGICAL SATELLITE shown as it rotates in an orbit 23,000 miles above earth, scanning 1,821 regions over the entire earth face.

spaces, will have a particularly fine view of southern New Mexico and, coupled with existing meteorological equipment for missile testing, will tell more about local weather than of any other location in the world, WSMR officials announced.

COL William C. Petty *commands the Atmospheric Sciences Laboratory (ASL), an element of the U.S. Army Electronics Command. A graduate of the Georgia Institute of Technology, the University of Alabama and several military schools, including the Command and General Staff College, he is a career communications specialist.*

Commissioned as a signal officer in 1951 at age 26, with subsequent service as an instructor at signal schools and the Command and General Staff College, he also has served as battalion commander in Europe and as commander of the Defense Communications Agency in Vietnam.

A veteran of World War II, he has been awarded the Legion of Merit, Bronze Star, Army Commendation with first Oak Leaf Cluster, a Vietnamese medal and several campaign and service ribbons.

Dr. Willis L. Webb, *who is in charge of the WSMR Meteorological Satellite Technical Area, is an ASL research meteorologist and also is a lecturer for the Physics Department at the University of Texas at El Paso. He is a graduate from Southern Methodist University, the University of Oklahoma and Colorado State University.*

Dr. Webb has edited two texts and authored three books. One, Structure of the Stratosphere and Mesosphere, *has been published in Russia. He has written about 40 articles, prepared 60 scientific presentations and has taught 25 university courses.*

L. Maurice Clelland *is an engineering management specialist. Graduated from Sul Ross State University and from New Mexico State University, he is studying for his doctorate at the University of Texas at El Paso.*

Clelland came to White Sands Missile Range in 1954 as a Department of the Army civilian after serving in both the Army and Navy. He worked in research on Instrumentation equipment until 1962, when he joined NASA, and currently is assistant to the manager at the NASA-White Sands Missile Range Test Facility, with additional duty as safety officer and public affairs officer.

William Vechione, *senior electronics engineer at the SMS-A Ground Station, is a former Army signal officer and a graduate of Texas Western University (now U.T.E.P.). He also has studied at the University of Alaska and the University of Colorado.*

Vechione has written about vacuum tube launchers in national scientific publications and is a registered professional engineer. During construction of the WSMR tracking site, Vechione was the federal technical representative in charge of insuring compliance with construction specifications.

WRAIR Improves Plethysmograph as Blood-Flow Monitor

Human blood circulation studies pertinent to causes of pulse pressure variations, such as differences between the right and left side of the body, can be performed more accurately with an improved plethysmograph developed by Walter Reed Army Institute of Research.

Allison Lee, an electronic technician in WRAIR's Department of Psychophysiology, is credited with developing the improved device, which has been used successfully in evaluating patients at Walter Reed Army Medical Center, Washington, DC, and the National Naval Medical Center, Bethesda, MD.

Designed specifically for studies of a condition known as causalgia, an intense burning pain in the arms or legs resulting from injury, sometimes lasting for years, the new plethysmograph electronically measures the volume of blood forced into body extremities with each heart beat.

Differences in blood pulse between the left and right sides of the body often is indicative of types of disease. Some previous blood flow studies have been proved invalid because of conditions which alter the pattern of flow of blood examined under the old plethysmograph sensing devices. These conditions included excess heat, pressure and the over-all nature of the test light.

Tiny, cool and quite specific in the type of light it generates, the improved plethysmograph can be used to monitor blood pressure on both sides of the body at the same time for extended periods without physical discomfort.

Normally, the one-quarter-inch square device, containing a light-emitting diode, is attached to a finger, toe or ear lobe. Infrared light used to measure blood flow by reflection from the blood into a phototransistor is recorded on a polygraph or tape machine.

PLETHYSMOGRAPH, containing a light-emitting diode, shown attached to the tip of finger, for blood circulation studies.

The signal can also be rerecorded on magnetic tape for permanent storage and then can be used later to compare both sides of the body blood flow as an aid in diagnosis.

Additional uses for the device in identifying ailments in other parts of the body are now being considered. Physicians at civilian and other military medical facilities have expressed keen interest in the improved plethysmograph.

2 SATCOM Engineers Design Test Set for Worldwide DSCS

Rapid and accurate evaluation of the performance of military satellite communications equipment is possible with a test set designed and built by two engineers at the Army Satellite Communications (SATCOM) Agency, Fort Monmouth, NJ.

Developed by Samuel E. Findler and Charles A. Bramble Jr., the programable carrier-noise test set will be used in the worldwide Defense Satellite Communications System.

Satellite communications links operate under a variety of technical and environmental conditions which result in a wide range of signal quality at the earth terminal receiver. The demodulator will perform quite differently when receiving a high-quality signal, or one said to have a high carrier-to-noise ratio, than it does when it is receiving a low-quality signal.

The test set is intended to make easier the evaluation of various modulator-demodulator (modem) configurations. It is designed to be compatible with automated testing techniques and it can be interfaced with a suitable programer to provide automatic performance testing.

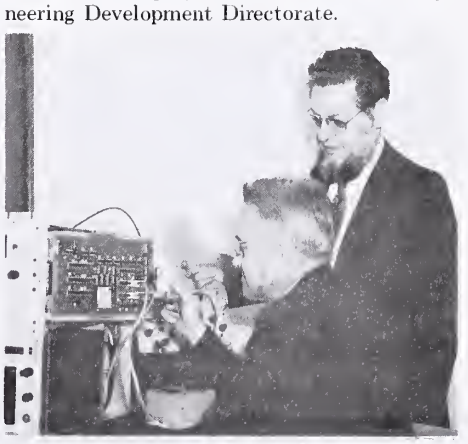
When used with a modem, the test set takes the transmitted signal, measures the carrier level, combines that carrier with an appropriate amount of noise, and sends the combined "carrier-to-noise" signal to the input of the demodulator.

Carrier-to-noise ratio is varied automatically over the range of the modem to provide a rapid analysis of the modem's characteristics. Front panel controls of the test set permit its operation with either digital or analog modems.

The test set is expected to provide a rapid and accurate means of evaluating modems used in the AN/TSC-54, AN/MSC-46 and AN/MSC-60 satellite communications earth terminals which the three military services operate throughout the world.

Designed specifically for satellite communications and digital modems, the test set reportedly is adaptable to any communication system and modulation technique.

Findler is chief of the SATCOM Agency's Tactical and Equipment Techniques Division. Bramble is a project engineer in the Engineering Development Directorate.



ENGINEERS Samuel E. Findler (right) and Charles A. Bramble Jr. conduct a test with the programable carrier-noise test set they designed and built at the SATCOM Agency, Fort Monmouth, NJ.

AIDAPS Goals Aimed at Use With AAH, UTTAS

Progress in development of an Automatic Inspection, Diagnostic and Prognostic System (AIDAPS) to reduce maintenance costs is raising hopes that it will be ready for incorporation into future aircraft such as the Advance Attack, Heavy Lift and Utility Tactical Transport Aircraft System helicopters.

The developmental program is sponsored by the U.S. Army Aviation Systems Command (AVSCOM) and was initiated several years ago at the Army Aeronautical Depot Maintenance Center (ARADMAC), Corpus Christi, TX. Contracts were awarded to two independent firms to study the feasibility of using such a system for evaluation of aircraft components for serviceability.

The UH-1 helicopter was selected to develop a pilot model and a limited number of known defective parts were implanted in otherwise serviceable and airworthy components. Changes in vibration, temperature, pressure and other variables were then compared to the component with all serviceable parts.

Early results were encouraging but deviation occurred in the recorded patterns (signatures) of components when any normal maintenance was performed on the components or related airframe parts. To determine if normal maintenance action could be detected and filtered out to obtain information about faulty components, another study was made by Parks College, St. Louis University, St. Louis, MO.

Results of the second test program were encouraging and a contract was awarded to Garrett Air Research Manufacturing Co., Torrance, CA, with support from the U.S. Army Aviation Test Board (AATB), for a flight evaluation phase.

Extensive preparations preceded active testing. In January 1973, AATB personnel began training selected individuals in depot level maintenance of UH-1 engines, main transmissions and gearboxes. Assistance was given by instructors from ARADMAC and field technical representatives from the Lycoming Division of AVCO Corp.

Special tools required for this level of maintenance were collected or fabricated. Record-keeping procedures were devised to meet the requirements for accurate and timely information about each major component tested and each implant or maladjustment time, defect, and allowable ground run or flight time limit. A data package was developed to provide ready reference material.

Four UH-1H helicopters for flight testing were provided to the AATB. Ballasted to fly light, medium and heavy weight configurations, they will be flown for specified periods of time to generate data for the program.

The engines, transmissions and gearboxes will be flown first with serviceable parts installed to obtain system "signatures" for baseline data. Later, faulty parts will be implanted or maladjustments made to establish "signatures" for abnormal conditions.

The four aircraft were prepared for this testing program by completely disassembling the engines, main transmissions and gearboxes to assure that all parts were within serviceable tolerances. Upon reassembly, the engines were first operated on a mobile engine test stand to assure proper functioning.

The engines and the reassembled transmissions and gearboxes were then installed on the aircraft. Each aircraft was operated in a static tiedown facility to assure proper functioning of the transmission and gearboxes prior to flight. The use of the engine test stand and static tiedown facility saved time and money by enabling the AATB to perform these required tests of the components rather than having to send the components to other facilities for these tests.

The system under development is expected to improve maintenance technology by permitting operation of major dynamic components of aircraft beyond currently specified time between overhaul periods, reducing removals and spare parts consumption, and reducing damage caused by frequent installations and removals.

More accurate inspections and continuous monitoring of primary aircraft components can then be directed to reducing aircraft accidents caused by mechanical malfunctions.

AIDAPS helicopter is secured to static tie-down facility by the cargo hook to qualify transmissions and gearboxes for flight. A brace is installed on the landing gear skids to prevent the cross tubes from bending due to tension of the tie-down.

MERDC, IFI Test ERDLator for Wastewater Uses

Feasibility of using modified U.S. Army water purification equipment to recycle wastewater generated by field units for reuse in laundry, kitchen and similar operations has been established in recent tests.

The most recent feasibility test was conducted at a commercial laundry in the District of Columbia as a joint effort of the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, VA, and the International Fabricare Institute, which represents the commercial laundry and dry-cleaning industry.

The purpose of the program, initiated at the request of the IFI, was to evaluate an MERDC-developed process having potential application for the treatment of commercial laundry wastewaters to meet anticipated U.S. Environmental Protection Agency effluent guidelines.

The DC tests, devoted exclusively to treatment of commercial laundry wastes, served as follow-up of earlier experiments at Camp A. P. Hill, VA, where successful treatment of kitchen, shower and laundry wastewaters generated from Army field units was reported.

Objective of the tests was to produce water that could be reused for nondrinking purposes. Physical constraints of the test setups precluded the actual recycling of the water. Laboratory analysis of the treated water, however, indicated to IFI and MERDC representatives that it was of suitable quality for such reuse.

Test results showed that the application of a modified standard water purifier, called the ERDLator, to the recycling effort may enable U.S. Army field units to establish a dual water treatment capability.

The standard purifier is already used to treat surface water for drinking purposes. A modified ERDLator can treat laundry, kitchen and shower wastewaters for nonconsumptive reuse.

Developed by the MERDC Sanitary Sciences Division, the treatment involves tank mixing of the wastewater with powdered activated carbon and polymer, transfer of the slurry to a standard ERDLator clarifier for solids/liquid separation, and the chlorination and filtration of the effluent through a pressure diatomite filter.

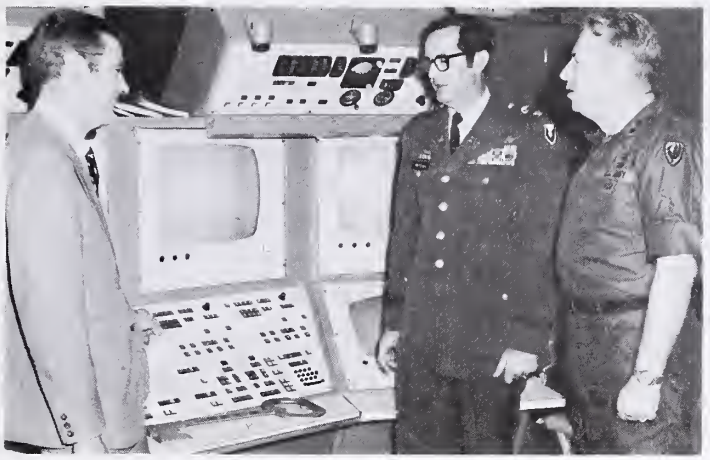
Minimal quantities of an easily dewatered waste carbon sludge are produced, thereby easing the disposal problem and the dissolved solids content of the treated water is not increased by the carbon and polymer additions. High removal of organic and heavy metal pollutants is attained. Quality of the product water appears insensitive to variations in the organic pollutant level of the feedwater.

MERDC evaluators said data obtained from the tests at Camp A. P. Hill and at the commercial laundry in DC indicate that the process has wide applicability, and can be used for the renovation of wastewaters from field military units and commercial laundries.

CLEAR WATER, which entered the van-mounted plant contaminated with laundry detergents and bleaches, exits thoroughly filtered and purified. MERDC's Dan Lent (left) and Dr. Manifred Wentz, research director International Fabricare Institute, check final product.

R & D NEWS

ATDA Gets SFTS to Mark 25th Year of Operations



SYNTHETIC FLIGHT TRAINING SYSTEM first production model was turned over officially to the U.S. Army Aviation School, Fort Rucker, AL, marking the beginning of the 25th year of operation of the U.S. Army Aviation Training Device Agency. BG James M. Leslie (right), assistant commandant of the school, was presented the keys to the SFTS by COL Myles H. Mierswa Sr., USATDA commander, center. Cliff Meldrum of the Singer Co., SFTS producer, explains capabilities of system.

Economies achievable through use of effectively engineered training devices came into focus when the U.S. Army Training Device Agency commander recently marked the beginning of the ATDA's 25th year of operation.

The occasion was the presentation to BG James M. Leslie, assistant commandant of the Army Aviation School, Fort Rucker, AL, of the keys to the first production model of a Synthetic Flight Training System (SFTS).

ATDA Commander COL Myles H. Mierswa Sr., who presented the keys, said the SFTS is expected to result in a decrease of 30 percent in use of aviation fuel required for pilot training at the Army Aviation School.

A developmental model was installed at the school in 1971 and used, as the new SFTS will be, in the instrument portion of the initial entry rotary-wing aircraft course. The SFTS consists of four UH-1H "Huey" helicopter simulated cockpits, four motion systems, one instructor console, and digital computer equipment.

Six additional SFTS units are scheduled for installation at the school, to provide a total of 32 cockpits to be used for instrument training as well as transition instruction and standardization of flight training methods and procedures. Estimated annual savings when the complex is completed will be 5.3 million gallons of aviation fuel.

Operating cost for the SFTS is $18.20 an hour as compared to $97.53 an hour for the UH-1 helicopter used by the Army Aviation School to teach the initial entry students. The cost of an SFTS product model is about $2.2 million.

COL Mierswa referred to the first SFTS production model as a "perfect example of TRADOC-AMC-industry cooperation." Team effort by the Training and Doctrine Command, the Army Materiel Command, the Singer Corp. and the procurement personnel at the Naval Training Equipment Center shortened production model procurement time to 14 months.

Californium-252 Radiation Source Installed at WES

Activation of a neutron radiation Californium-252 source to test soil samples is scheduled to enhance research capabilities of the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, in the near future.

Installed in the Soils and Pavements Laboratory, the radiological source will enable WES scientists to determine the moisture heterogeneity of soil and rock samples without breaking them for analysis.

A soil sample is irradiated with the Californium-252 isotope and the neutrons passing through dry areas expose a piece of photographic film; neutrons absorbed by moist spots fail to register on the film. The picture shows varying degrees of moisture within the sample.

Stored at the bottom of a large stainless steel tank of water extended six feet below ground level, the radioactive isotope consists of two capsules weighing about 5 milligrams each. The chemically treated water and concrete around the tank provide shielding against radiation.

During a test the isotope is raised by an aluminum tube to a point on the inside wall from which radiation can be beamed and controlled toward the test specimen. Results are recorded on photographic film or through a scintillator as x-y plots on a graph.

Determination of moisture irregularities in soil and rock has applications to military requirements in many ways. With the new irradiation capability, it will be possible to follow the movement of fluids in soil models to obtain data on the movement of moisture during swelling, on soil changes resulting from ballistic penetrations, and on liquification caused by earthquakes.

X-ray technology has been used at WES for many years to study interior characteristics of soil and rock, but such radiation does not reveal moisture gradations.

'Cutaneous Communication' Studied for Sentry Use

"Cutaneous communication" between a sentry at a remote post, surrounded by hostile forces, and his combat commander—a concept originated about 10 years ago—is still being investigated by the U.S. Army Electronics Command.

Under development by ECOM's Automatic Data Processing Laboratory, the system involves skin stimulation by an electrical pulse transmitted in a Morse code-like pattern, currently with a maximum rate of 12 words a minute. Two small electrode pins mounted in a plastic slab and attached to the sentry's body give him a skin-tingling sensation when the message is transmitted.

The advantage of the system is that the sentry's position is not jeopardized by any light or sound while the message is being transmitted. Similarly, the location of the transmitting source is not disclosed. The pulse signal may vary, in the established code format, from a light tingle to a sting.

Signal generators have been used thus far for transmission of the electrical pulse. Ultimately, it is believed that tactical radios and wire communications equipment may be used.

Studies during the past 10 years have been concentrated on determining the most effective configuration of the electrodes and what type of pulse provides optimal skin stimulation without pain. Optimal electrical contact is provided by use of plain adhesive tape to strip away many of the dead cells on the surface of the skin.

Project engineer John McCray says the best electrical impulse has been found to be a constant-current biphasic-interrupted square-wave signal. Current is kept constant at less than one milliamp, with intensity controlled by varying voltage. The rate is 300 pulses per second with one-half millisecond interval between biphasic pulses.

The exact message type format to be used with the system has not yet been decided upon, although standard order and reply communication procedures are being considered.

Another possible application for the device is utilization as a cueing system, where an impulse serves merely to alert the soldier that a standard audio message is to follow.

GETTING THE MESSAGE, a soldier takes down signal coming to him through a cutaneous communications device strapped to his arm. Inset shows the side of the device that rests against the skin. Electrodes do not penetrate the skin, nor cause pain.

Army R&D Achievement Awards . . .

Prestigious Recognition Given to 45 Scientists, Engineers For Contributions to Army Through In-House Research

Forty-five scientists and engineers working at U.S. Army in-house laboratories are recognized in announcement of Army Research and Development Achievement Awards for 1974. Nine individuals and 10 teams were selected for the most prestigious annual recognition given to in-house personnel.

Army Chief of Research, Development and Acquisition LTG John R. Deane Jr. and Army Chief Scientist Dr. Marvin E. Lasser will continue the tradition, established in 1967, of presenting the awards during visits to the installations where the winners are employed.

Following substantially the criteria established originally in 1961, the awards are presented for in-house scientific or engineering achievements that: provide a basis for subsequent technical improvement of military importance; materially improve the Army's technical capability; and/or materially contribute to the national welfare.

Six researchers will receive the award for team development of a Laser Alarm/Locator System to protect combat vehicle crews from laser-guided weapons. A 5-man team will be honored for demonstrating an advanced propulsion system capable of doubling the velocity of shoulder-launched antitank weapons.

Other teams will receive awards for development of new concepts for boresighting artillery weapons, a weapons closed-loop fire-control system, a nuclear warhead section for the Lance missile system, a lightweight company mortar system, and a major breakthrough in optical guidance technology for line-of-sight missile systems.

Individual awards will be made for advances in the defensive posture against toxic chemical agents, redesign of the M16 Rifle to be used as a port firing weapon for the Mechanized Infantry Combat Vehicle (MICV), revision of the design of hardened underground structures, and development of new aptitude tests and methods of training the American soldier in the volunteer Army.

Nominations for the awards, consisting of a distinctive wall plaque and a bronze medallion desk decoration, were made by the commander of the Army Materiel Command, the Chief of Engineers, and the Deputy Chief of Staff for Personnel.

Winners were selected by a 7-man panel of judges representing the major scientific disciplinary areas, chosen from the key professional staff within the Office of the Chief of Research, Development and Acquisition, HQ Department of the Army.

Army Chief Scientist Dr. Lasser was chairman of the panel. Members were Dr. Ivan R. Hershner, scientific director of Army Research; Dr. Richard L. Haley and Dr. Vitalij Garber, scientific advisers to the Director of Developments; COL Garrison Rapmund, chief of the Life Sciences Office, Army Research Directorate (ARD); Merrill V. Kreipke, Environmental Sciences Office, ARD; and LTC James E. Drummond, Command Systems Division, Developments Directorate.

The winners are listed, as follows, within the major command, subcommand and installation at which they are employed, with a description of their achievements taken from their nomination citations.

ARMY MATERIEL COMMAND, **Armament Command,** Rock Island, IL. A 6-man team from *Frankford Arsenal* Pitman-Dunn Laboratory, Philadelphia, PA, was selected for development of a Laser Alarm/Locator System (LALS). The system instantly alerts the target crew to invisible laser radiation, locates the laser, and makes maximum use of existing equipment on board combat vehicles to direct counterfire.

The team members are *Joseph A. Constantino, Edward W. Stuebing, Jeffrey R. Heberley, Howard C. Guertler, Thomas E. Weiner* and *Jerry Neimark.* They were nominated for recognizing the need for such a counter-measure, and for design and fabrication of the system in less than six weeks in order to meet critical field test schedules.

Another R&D Achievement Award will go to *John L. DiGirolamo* and *John J. Petrucco,* both with the Artillery and Infantry Weapons Branch, Fire Control Development and Engineering Directorate at the arsenal. They were selected for contributions to the development of a new concept for boresighting artillery weapons that will provide a significantly improved capability.

DiGirolamo and Petrucco used the perpendicular relationship of the gun trunnion to the gun tube and developed an alignment device that permits parallel alignment of the sighting equipment to the trunnion. Rotation of the sight, using its own calibrated mechanism, permits alignment parallel to the gun tube. The device is operational during all lighting and weather conditions.

A third group award to Frankford personnel will be presented to *Michael D. Langan* and *Joseph E. Junier,* Fire Control Development and Engineering Directorate. They were cited for concept formulation, design and implementation of a closed-loop fire control system that will significantly increase the effectiveness of field artillery as a tactical weapon.

The system allows, for the first time, the use of conventional field artillery weapons to engage moving targets with effective indirect fire.

Picatinny Arsenal, Dover, NJ. Four engineers assigned to the Nuclear Development and Engineering Directorate will be honored with Army R&D Achievement Awards for team effort on the nuclear warhead section for the Lance missile system.

George I. Jackman, John F. Hasko, Alfred H. Franz and *Grant H. Dorwart* were credited as directly responsible for the successful development, evaluation and deployment of the warhead section. The Lance missile system is termed the most advanced surface-to-surface weapon the Army has developed.

Edgewood Arsenal, Aberdeen Proving Ground, MD. *Dr. Joseph Epstein,* Chemical Laboratory, was cited for technical contributions that have led to significant advances in the United States defensive posture against toxic chemical agents.

His citation states: "Through his fundamental studies on the chemical behavior of toxic chemical agents and his imaginative interpretation of data, he has been able to elucidate the factors responsible for their chemical reactivity and to determine the structural requirements of other chemicals to react rapidly with them.

"This understanding has led to development of methods for treating contaminated water supplies; new techniques for in-situ generation of chemicals; and selection of simulants for testing of alarms. . . ."

Watervliet (NY) Arsenal. A 7-man team of engineers and technicians from the Benet Weapons Laboratory is credited with completion of the advanced development of a new Lightweight Company Mortar System weapon designated as the Mortar, 60mm, XM224.

The weapon is designed to provide a man-portable indirect fire support system for the infantry rifle company. It will be capable of replacing the 81mm mortar in terms of effectiveness, increased rates of fire, better weapon stability and reduced weight.

Team members credited with development of this weapon system design, which also provides a secondary capability for hand-held firing when engaging targets with the direct-lay method, are *Edward G. Frezon, Howard D. McAlonie, Richard H. Cole, James T. Feldmaier, Eleanor M. Hickok, Elden D. Taft* and *Joseph Marsiglia.*

Missile Command, Redstone Arsenal, AL. *Donald J. Ifshin, John M. Tate, Chester W. Huskins, Seiford F. Schultz* and *Jerrold H. Arszman,* all with the Missile RD&E Laboratory, were commended for the demonstration of an advanced propulsion system. It has proved capable of doubling the velocity of shoulder-launched, man-portable antitank weapons, thereby achieving a much higher kill probability against armored vehicles than the existing M-72 light-assault weapon.

A second MICOM group award was presented to *Robert L. Sitton, Walter E. Miller, Jimmy R. Duke* and *Robert R. Mitchell* for a "major breakthrough" in optical guidance technology for line-of-sight systems achieved in the Missile RD&E Laboratory.

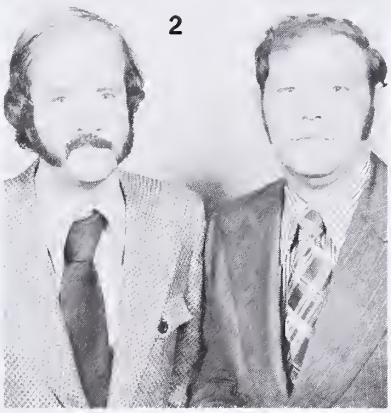
The team conceived, designed and demonstrated feasibility of an optical beamrider concept that "negates effects of presently conceived optical countermeasures while offering other significant advantages over conventional command-to-line-of-sight concepts."

The concept is based on utilization of a coded Gallium Arsenide laser beam that is pointed at the intended target. Special detectors and equipment on the missile determine its position in the beam and cause the missile to fly along the beam to the target.

Electronics Command, Fort Monmouth, NJ. R&D Achievement Awards will be presented to a ECOM headquarters 2-man team and for an individual accomplishment at the ECOM Atmospheric Sciences Laboratory (ASL), White Sands Missile Range, NM.

Octavius Pitzalis Jr. and *Russell A. Gilson,* ECOM Electronics Technology and Devices


1

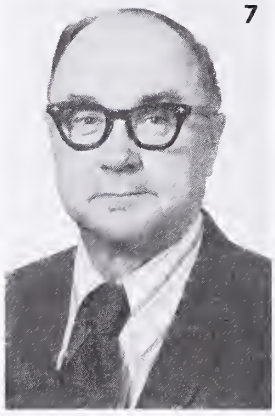

2


3


4


5


6


7


9

R&D Achievement Award Winners

Frankford Arsenal, *Philadelphia, PA*—**(1) From left, Jeffrey R. Heberley, Thomas E. Weiner, Joseph A. Constantino, Edward W. Stuebing, Jerry Neimark and Howard C. Guertler. (2) Michael D. Langan and Joseph E. Junier. Another team award went to *Frankford Arsenal* employes John L. DiGirolamo and John J. Petrucco (picture unavailable).** Picatinny Arsenal, *Dover, NJ*—**(3) Left to right, top to bottom, George I. Jackman, Grant H. Dorwart, John F. Hasko and Alfred H. Franz.** Edgewood Arsenal, *MD*—**(4) Dr. Joseph Epstein.** MICOM, *Redstone Arsenal, AL*—**(5) Donald J. Ifshin (6) John M. Tate (7) Chester W. Huskins (8) Jerrold H. Arszman (9) Seiford F. Schultz.** AVSCOM, *St. Louis, MO*—**(10) Dr. Fredric H. Schmitz.** MICOM—**(11) Walter E. Miller, Jimmy R. Duke, Robert R. Mitchell and Robert L. Sitton.** ECOM, *Fort Monmouth, NJ*—**(12) Octavius Pitzalis Jr. and Russell A. Gilson. Another *ECOM* winner, Thomas H. Pries, *ASL, WSMR,* is not shown.** AVSCOM—**(13) C. Rande Vause.**


10


11


12

R&D Achievement Award Winners

Ballistic Research Laboratories, *APG, MD*—**(1) Dr. Ceslovas Masaitis (2) Timothy L. Brosseau.** Construction Engineer Research Laboratory, *Champaign, IL*—**(3) Dr. Walter E. Fisher,** Army Materials and Mechanics Research Center, *Watertown, MA*—**(4) Donald R. Messier and Philip Wong.** Waterways Experiment Station, *Vicksburg, MS*—**(5) William J. Flathau.** Army Research Institute for the Behavioral and Social Sciences (ARI), *Arlington, VA*—**(6) Dr. Robert T. Root.** Engineer Topographic Laboratories, *Fort Belvoir, VA*—**(7) Franklin R. Norvelle.** ARI, BERSRL—**(8) Edmund F. Fuchs. A 7-man team from** Watervliet (NY) Arsenal **(picture not available) is comprised of Edward G. Frezon, Howard D. McAlonie, Richard H. Cole, James T. Feldmaier, Eleanor M. Hickok, Elden D. Taft and Joseph Marsiglia.**

Laboratory, were cited for conceiving and promoting an important innovation for conventional microwave power transistors that reportedly is revolutionizing the role of the transistor in modern broadband power amplifiers.

As a result of the innovation, their citation states "these transistors have significantly enhanced performance, improved reliability and producibility, and lowered the cost of modern broadband power amplifiers by as much as 40 percent. Transistors embodying this concept have replaced conventional transistors in all new designs of broadband microwave transistor power amplifiers."

Thomas H. Pries, ASL, was nominated for his theoretical evaluation and successful demonstration of a new concept for real-time sensing of the average crosswind along a straight line path through the atmosphere over distances up to two kilometers.

This sensing concept is based on the analysis of scintillation of a laser or light beam and greatly improves the Army's technical capability to provide wind corrections for Automatic Cannon, Free-Flight Rockets and High-Energy Laser Systems.

Aviation Systems Command, St. Louis, MO. *Dr. Fredric H. Schmitz* and *C. Rande Vause,* aerospace engineers with the AVSCOM Ames Research Center, were nominated for R&D Achievement Awards in recognition of their contributions to the Army's airmobile concept. They were cited for development of "near-optimal helicopter takeoff technique."

This achievement was accomplished by "combining sophisticated optimal-control analyses with a detailed helicopter performance model to define near-optimal takeoff trajectories yielding a simplified and practical solution to the heavily loaded helicopter takeoff problem."

Separate AMC Installations. *Ballistic Research Laboratories,* Aberdeen Proving Ground, MD. BRL selectees for R&D Achievement Awards are *Dr. Ceslovas Masaitis,* a mathematician in the Applied Mathematics Laboratory, and *Timothy L. Brosseau,* mechanical engineer, Interior Ballistics Laboratory.

Dr. Masaitis was cited for his development of new mathematical models to determine the effects of tradeoff factors of armor and mobility, and to consider associated questions in the design of tanks—"especially to maximize the probability of survival of tank and crew, and the probability of the accomplishment of their mission."

Brosseau was recognized for redesigning the M16 Rifle to be used as a Port Firing Weapon for the Mechanized Infantry Combat Vehicle (MICV). The Small Arms Systems Agency proposed the original concept. Brosseau, in response to an SASA request, evaluated and improved the concept. He designed and developed the prototype weapon, aided by an analog computer model of the mechanism and a digital model of the gas system previously developed by BRL.

Army Materials and Mechanics Research Center (AMMRC), Watertown, MA. *Donald R. Messier* and *Philip Wong* will receive awards for research accomplishments on "Silicon Nitride for Gas Turbine and Random Applications." Results have led to significant improvements in the technology of production of reaction-sintered silicon nitride.

Their work has shown that proper control can result in easy nitridation of high-purity

(99.99 percent) silicon, and the over-all current commercial firing time can be reduced as much as 40 percent without sacrificing material quality. Application of the technology to commercial practice is expected to result in more economical silicon nitride.

OFFICE, CHIEF OF ENGINEERS. *Construction Engineer Research Laboratory (CERL),* Champaign, IL. *Dr. Walter E. Fisher,* chief of the Structural Mechanics Branch, was recognized for his conceptual development and design of a biaxial shock test facility that "incorporates a versatile, high-performance testing device into a unique process for dynamic response evaluation."

The test facility will enable engineers to design equipment for "hardened" structures to resist weapon effects, earthquakes and severe wind conditions. The system, according to his citation, has revolutionized the industry and has been adopted by others with similar motion simulation problems.

Waterways Experiment Station, Vicksburg, MS. *William J. Flathau,* chief of the Weapons Effects Laboratory, will receive an R&D Achievement Award for his efforts in support of the Supreme Headquarters Allied Powers Europe (SHAPE) to revise the design of hardened underground structures.

The research was conducted within a short time-frame to validate procedures he had recommended to provide the desired degree of protection at minimum cost. Further, his citation states, his efforts "provided a hardened structure suitable for its intended use rather than one which, if constructed as originally planned, would have been unsatisfactory."

Engineer Topographic Laboratories (ETL), Fort Belvoir, VA. *Franklin R. Norvelle* designed the hardware configuration of the Analytical Photogrammetric Positioning System (APPS). It enables field Army users to locate rapidly the coordinates and elevations of ground points through 3-dimensional aerial photography. The APPS has been accepted by the Army as a standard system and is currently undergoing tests with field units in the United States and Europe.

OFFICE, DEPUTY CHIEF OF STAFF FOR PERSONNEL. *Army Research Institute (ARI) for the Behavioral and Social Sciences,* Arlington, VA. *Edmund F. Fuchs,* Individual Training and Performance Research Laboratory, was selected for his technical leadership in development of the Armed Services Vocational Aptitude Battery (ASVAB) for Joint Services Recruiting. He was cited also for initiating and directing research that resulted in the introduction of a new Army Classification Battery (ACB) and Aptitude Area System. Both accomplishments serve needs of the volunteer Army.

Dr. Robert T. Root, ARI Unit Training and Educational Technology Systems Technical Area, was selected for development of an innovative method of training the American soldier in small unit tactical techniques. Described in the May-June *Army R&D Newsmagazine,* page 7, as REALTRAIN, because of the realism injected into training, the method has been adopted by the Infantry School and implemented in infantry units worldwide.

RDT&E Career Certificate Program . . . *5 Enrollees Complete Requirements at ALMC*

Five enrollees in the Army Research, Development, Test and Evaluation Career Certificate Program have completed requirements at the U.S. Army Logistics Management Center, Fort Lee, VA.

Announcement of the first certificate award was made in June by John Brockwell, chief of Academic Evaluation in the Directorate of Educational Technology at the ALMC.

Walter W. Flynn, chief of the Plans and Programs Division, Research, Development and Engineering Directorate, HQ Army Materiel Command, presented the award to Alan R. Loper, a member of the ALMC staff, before an RDT&E class of 40 students.

Frequently a guest speaker at the ALMC on "Army R&D Management," Flynn was described by Brockwell as a "real pusher of the RDT&E Certificate Program."

Certificates will be presented in the near future to John M. Thorp, Walter Dzingola, Tommy L. Plummer and Gordon L. Uzzell at the installations where they are employed or at an ALMC ceremony (undecided at press time).

Employed at HQ U.S. Army Aviation Systems Command as an aeronautical engineer, Thorp has completed 12 courses. Dzingola is a Picatinny Arsenal employe at Dover, NJ, Plummer is with the AMC Inspector General's Office at St. Louis, MO, and Uzzell is with the AMC Heavy Lift Transport Aviation Systems, St. Louis, MO.

CERTIFICATE OF COMPLETION of the Army Logistics Management Center's (ALMC) Research, Development, Testing and Evaluation (RDT&E) Program is presented to Alan R. Loper (right), a member of the ALMC staff, by Walter W. Flynn, chief of Plans and Programs Division, RD&E Directorate, HQ AMC.

"We are making every effort to stimulate interest in the opportunities for career advancement offered by this program. It is one of the eight ALMC career education programs," Brockwell stated.

Enrollees in the RDT&E Certificate Program must complete eight courses, four of which are 2-week residence courses at the ALMC. Six electives also are offered by the ALMC, and two must be completed at the ALMC.

Participating in the RDT&E Certificate Program of the ALMC course offerings are the Industrial College of the Armed Forces, Fort McNair, Washington, DC, the Air Force Institute of Technology at Wright Patterson AFB, OH, the Naval Materiel Command, Washington, DC, and many similar educational institutions.

Further details regarding the program may be obtained by writing to: Commander, USALMC, ATTN: AMXMC-ET-AEO, Mr. John Brockwell, Fort Lee, VA 23801.

AMC Sets Energy Conservation Award Deadline

Nominations for a new Army Materiel Command Energy Conservation Award established by GEN Henry A. Miley Jr., commander, must be received at HQ AMC by Aug. 1. The award will be made on a quarterly basis to major subordinate commands, depots and individuals for outstanding achievement.

In a letter to all commands announcing the award, GEN Miley stated that it will "provide meaningful recognition to organizations and individuals within AMC who have achieved a place above the rest in the field of safeguarding our energy resources."

The award will consist of a plaque for installations and a scroll for individuals. The installations and logistics organization of each major command will nominate award candidates.

2 Earn Patents for Mortar Work at Watervliet

Two Watervliet Arsenal, NY, engineering technicians were recently granted U.S. patents for separate inventions credited with increasing the operating efficiency of in-house developed mortars.

James T. Feldmaier, Mortars and Recoilless Rifles Division, devised a firing mechanism for hand-held mortars. A manual selector switch positions the trigger and indicates if the firing pin is in a fixed-firing or non-firing mode. The system prevents accidental firing of a round if dropped into the muzzle of the mortar barrel.

William H. Ziegler, Applied Mathematics and Mechanics Division, received his patent for a fluidic control system which detects a predetermined amount of either azimuth or elevation movement due to recoil displacement of the mortar tube during firing.

A LESSON IN ECONOMICS. "It has been estimated that, for every dollar spent on basic research, $10 is needed for development, and $100 for the introduction of the new product."—P. H. Abelson, 1971.

Army Science Conference Features . . .

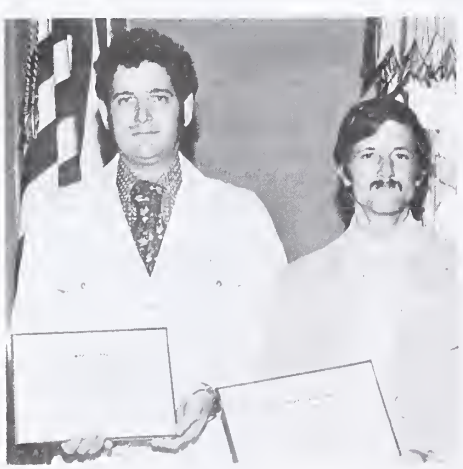
Awards for 17 of 96 Tech Papers, Volunteer Army Panel

MAKING HIS FAREWELL appearance at 1972 Army Science Conference, the late Dr. Richard A. Weiss receives accolade and a Certification of Appreciation for 15 years of dedicated ASC service from former Secretary of the Army Robert L. Froehlke.

Dedicated to the memory of "Founding Father" Dr. Richard Weiss, the 1974 Army Science Conference at the U.S. Military Academy, West Point, NY, June 18–21, featured 96 technical presentations, with 17 honored by awards, and a panel discussion on "The Volunteer Army's Investment for the Future."

Additional highlights included the keynote address by Army Chief of Research, Development and Acquisition LTG John R. Deane Jr., the banquet address by Army Scientific Advisory Panel Chairman Lawrence H. O'Neill, and comments by Assistant Secretary of the Army (R&D) Norman R. Augustine prior to his presentation of awards for technical papers.

Dr. Weiss, who died Mar. 18, 1974, at the age of 64, was chairman of the Advisory Committee and general chairman from the first ASC in 1957 until his retirement less than two weeks after the 1972 conference. He was deputy and scientific director of Army Research, Office of the Chief of Research and Development, 1958–72, and an Army scientist more than 31 years—distinguished in numerous key positions.



ASC $500 Award for second best technical paper (tie for this honor) was presented to Dr. Andrew M. Dietrich and Dr. Victor Geenhut (coauthor Stanley Golaski absent) of Ballistic Research Labs.

Nearly 400 scientific leaders representative of Department of Defense agencies, selected U.S. Army key scientists from major R&D installations, authors and coauthors of technical papers, and invited R&D administrators in defense establishments in the United Kingdom, Canada, Australia, New Zealand and France participated in the 1974 conference.

The prestigious Dr. Paul A. Siple Memorial Medallion, honoring the memory of the U.S. Army's world-famed cold regions explorer who started his career with the first expedition of Admiral Byrd to the Antarctic (1928–30), was presented to a 4-man research team at Walter Reed Army Institute of Research.

Recipients of the 3-inch silver medallions and a $1,000 honorarium are CPT James W. LeDuc, William Suyemoto, LTC Bruce F. Eldridge and COL Philip K. Russell. All except Suyemoto are members of the Army Medical Service or the Medical Corps. CPT LeDuc presented the paper, "Transovarial Transmission of California Encephalitis by Floodwater Mosquitoes."

This discovery, that a mosquito can harbor a virus through adverse environmental conditions and pass it on to a subsequent generation, is termed "of great epidemiological importance." Its significance is related to the widespread scourge of equine encephalitis during 1971 in Mexico and a southwest portion of the United States.

The mosquito-borne epidemic was brought under control by use of a vaccine developed by an Army Medical R&D Command scientific team in the Medical Research Institute of Infectious Diseases, Fort Detrick, MD. A Department of Agriculture Superior Service award recognized the achievement, culminating 18 years of R&D effort.

The U.S. Army Incentive Awards Program made possible the presentation of a total of $3,350 in honorariums for technical papers at the 1974 ASC. Large bronze medallions accompanied each of the presentations. Two awards of $500 were made, one going to Dr. J. Roland Gonano of the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, VA, for "Concealed Explosives Detection by Means of Nuclear Resonance."

This discovery is pertinent to the large number of casualties in modern land warfare attributable to concealed explosive including mines, such as were reported during the conflict in Southeast Asia. It also has application to the civilian mail bombs problem.

An experimental detector has shown in tests that it "is highly resistant to false alarms, and can detect mail bombs in the presence of metal and large amounts of interfering hydrogenuous materials."

The second $500 honorarium was presented to a 3-man scientific team representative of the U.S. Army Ballistic Research Laboratories, Aberdeen (MD) Proving Ground. Coauthors of "A Method of Controlling Shock-Induced Damage in Aluminum Alloys" are Dr. Andrew M. Dietrich, Dr. Victor Greenhut and Stanley K. Golaski.

Reporting on extensive testing to verify theoretical concepts, this paper is regarded as having "very important applications" to

ARMY CHIEF SCIENTIST and Director of Army Research Dr. Marvin E. Lasser joins Assistant Secretary of the Army (R&D) Norman R. Augustine in congratulating Siple Award Winner CPT J. W. LeDuc, coauthor of paper by 4-man team at Walter Reed Army Institute of Research that shared ASC top honor and a $1,000 honorarium.

the problem of increasing the durability and reliability of alloys in military materiel.

U.S. Army Electronics Command scientist Louis J. Jasper won a $350 award for a paper titled "Radial Beam Microwave Amplifier." Described in his abstract as a new class of tubes in the latest generation of microwave tubes, known as the printed circuit traveling-wave tubes, the technology is regarded as having many applications.

Possible military utilization includes phased-array radar tubes and expendable signal transmission jammers. Envisioned civilian applications include transponders, microwave ovens and microwave links.

Four identical awards of $250 each were presented, as follows:

- Picatinny Arsenal, Dover, NJ, Dr. David S. Downs, Dr. Wayne Garrett, Dr. Donald A. Wiegand, Dr. Thaddeus Gora, Dr. Harry D. Fair Jr., Marcel Blais and Arthur C. Forsyth, for "Photo- and Electric Field Effects in Engergetic Materials."
- U.S. Army Air Mobility R&D Laboratory, Moffett Field, CA, Dr. Charles E. Hammond, for "Helicopter Ground Resonance Analysis in Light of Army Requirements."
- Army Electronics Laboratories, Fort Monmouth, NJ, Dr. Herbert A. Leupold and Dr. Frederick Rothwarf and Harry Diamond Laboratories, Washington, DC, Dr. Carl J. Campagnoula, Johnathan E.

Top individual award winner ($500) Dr. J. Roland Gonaro of the Mobility Equipment R&D Center is congratulated by ASA (R&D) N. R. Augstine.

Fine and Henry Lee, for "Design of Magnetic Sensors for Obtaining and Environmental Safety Signature."

• Institute of Surgical Research, Brooke Army Medical Center, Fort Sam Houston, TX, LTC Douglas W. Wilmore, MAJ James M. Long, SP4 Robert W. Skreen, Dr. Arthur D. Mason Jr. and COL Basil A. Pruitt Jr. Their paper is titled "Metabolic Rate, Ambient Temperature and Catecholamines: Interrelationships Following Thermal Injury."

Certificates of Achievement signed by Assistant Secretary of the Army (R&D) Norman R. Augustine and Chief of Research, Development and Acquisition LTG John R. Deane Jr. were presented to each author or coauthor of an award winning paper, including 9 Meritorious Papers as follows:

• Harry Diamond Laboratories, Washington, DC, Philip S. Brody and Frank Crowne, "Large Polarization Dependent Voltages in Ferroelectric Ceramics."

• Rock Island (IL) Arsenal (GEN Thomas J. Rodman Laboratory), Dr. Shih-Chi Chu, "A More Rational Approach to the Stress Analysis of Gun Tubes."

• U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS, Thomas E. Kennedy and Robert E. Walker, "Experimental Determination of Shock and Vibration Levels Inside the Safeguard (Antiballistic Missile Defense) Perimeter Acquisition Radar Building." Also, Jerry R. Lundien, "Mathematical Simulation of Rayleigh Wave Generation and Propagation in Ground Media."

• HQ Electronics Command, Fort Monmouth, NJ, Robert H. Pearce, "A Technique for Determining a Universal Drag Function for Use in Weapon Location Radars." Also, V. J. Rosati, "20 PPS Holmium: Yttrium Lithium Fluoride Laser Transmitter."

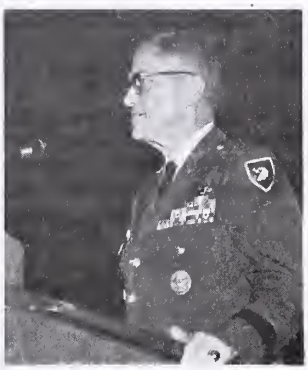
(Rosati's paper was the only one selected from 17 "Supplemental Papers," that is, those picked by the panel of judges for possible presentation in the event any of the 96 principal papers should be withdrawn.)

• Mobility Equipment R&D Center, Fort Belvoir, VA, Dr. Johann A. Joebstl, Grayson W. Walker and William A. Adams, "Investigation of Electrocatalysts by Low-Energy Electron Diffraction and Related Techniques."

• Army Missile Command, Redstone Arsenal, AL, Dr. E. L. Wilkinson and Dr. R. L. Hartman, "A Novel Laser Radar Range."

ASAP CHAIRMAN Lawrence H. O'Neill presents banquet address on "Impressions of AMARC (Army Materiel Acquisition Review Committee)" on which he served as a member of one of six subcommittees.

CHIEF OF RDA (Research, Development and Acquisition) LTG John R. Deane Jr. gives keynote address at ASC. The following day he took an assignment as Acting Assistant Secretary of the Army (I&L).



U.S. Military Academy Superintendent LTG William A. Knowlton makes his third and final appearance before ASC participants. In August he will become chief of staff, U.S. Army European Command.

• Picatinny Arsenal (Feltman Research Laboratory), Dover, NJ, Dr. Jagadish Sharma, Dr. Thaddeus Gora, Dr. Suryanarayana Bulusu and Dr. Donald A. Wiegand, "X-Ray Photoelectron Spectroscopy of Explosive Solids."

Not selected for an award but given a rousing round of applause from a large audience in Subsession D-V was a paper presented by SP4 James J. Pinto of Frankford Arsenal, Philadelphia, PA. A member of the Army Scientific and Engineering Program for Enlisted Men for the past 16 months, he is a 23-year-old graduate from Manhattan (NY) College with a BS degree in physics.

WINNER OF $350 individual award, Dr. Louis J. Jasper Jr., of HQ U.S. Army Electronics Command, Forth Monmouth, NJ, receives congratulations.

SP4 Pinto coauthored with Dr. Edward W. Steubing, Dr. Frank D. Verderame and Robert W. Doherty a paper titled "An Investigation of Infrared Extinguishing Aerosols for Camouflage Applications." He presented the same paper at a recent Department of Defense conference on lasers at the Air Force Academy, Colorado Springs, CO.

Three additional members of the Army Scientific and Engineering Program for Enlisted Men were coauthors of another all-military team paper presented by CPT Thomas S. Spencer, "Interactions Between Mosquito Repellents and Human Skin." SP4s Steven F. Bayles, Ronald K. Shimmin and Mark L. Gabel, and COL William A. Akers, all with Letterman Army Institute of Research, were coauthors.

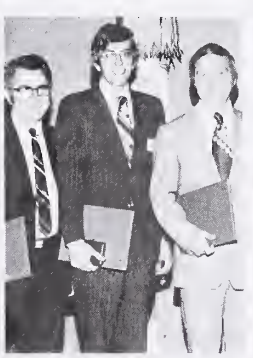
In 1962, the Army Science Conference top award of $500 went to SP4 Ira C. Felkner of the U.S. Army Chemical Corps at the Fort Dietrick (MD) Laboratories for "DNA Isolation by an Improved Procedure for Transformation of Bacillus SP."

Women are playing an increasingly important role in Army science, as attested by numerous high awards accorded them in recent years—many of them presented by professional societies and the communities in which they have resided—but only two members of the fair sex presented papers at

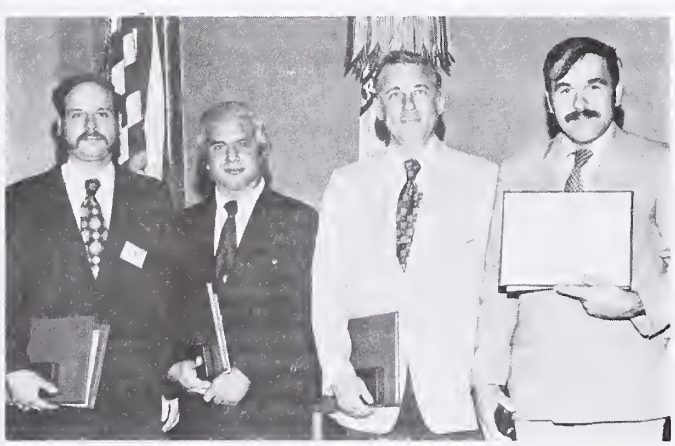
(Continued on page 13)

REPRESENTING 5-MAN team, LTC Douglas W. Wilmore accepts $250 award from ASA (R&D) N. R. Augustine. Other members of U.S. Army Institute of Surgical Research (Brooke AMC) team are MAJ James M. Long, SP4 Robert W. Skreen, Dr. A. D. Mason, COL B. A. Pruitt.

INDIVIDUAL AWARD of $250 is presented to Dr. Charles Hammond of the Langley Directorate, of the NASA facilities at Langley Air Force Base, an element of U.S. Army Air Mobility R&D Laboratory, Moffett Field, CA.



7-MAN TEAM winners from Picatinny Arsenal shared $250 award. L. to r. are Dr. Donald A. Wiegand, Dr. Thaddeus Glora and Dr. Harry C. Fair. (Absent, Dr. David S. Downs, Dr. Wayne Garrett, Marcel Blais and Arthur C. Forsyth.)



5-MAN TEAM winners of $250 award are (l. to r.) Jonathan E. Fine and Dr. Carl J. Campagnoulo (Henry Lee absent), Harry Diamond Labs, Dr. Frederick Rothwarf and Dr. Herbert A. Leupold, Electronics Command Laboratories.

ASC Features 17 Awards, Volunteer Army Panel

(Continued from page 13)

the 1974 ASC.

Ms Joyce L. Illinger teamed with Dr. Robert W. Lewis and Dr. Dennis B. Barr of the Army Materials and Mechanics Research Center as coauthors of "Effect of Interlayer on the Impact Resistance of Acrylic/Polycarbonate Laminates." The paper reports on improved materials for windshields in military aircraft.

Ms Diana L. Frederick and John E. Higgins of Frankford Arsenal coauthored "Rapid Case Design Using Finite Element Stress Analysis and NASTRAN," a report on new time and cost reduction techniques in design of cartridge cases.

Panel of Judges. Award-winning papers presented at the 1974 ASC were selected by a panel of judges headed by Dr. Marvin E. Lasser, chief scientist, Department of the Army. Members were Dr. Robert A. Beaudet, Department of Chemistry, University of Southern California; Dr. David L. Fried, Optics Science Consultants; Howard P. Gates Jr., private consultant; Dr. Richard O'Neil Hundley, R&D Associates; and Dr. Herbert L. Ley Jr., medical consultant in foods and drugs, and former Commissioner of the Food and Drug Administration, U.S. Department of Health, Education and Welfare.

KEYNOTE ADDRESS. Presiding Chairman Dr. M. E. Lasser preceded his introduction of Chief of Research, Development and Acquisition LtG John R. Deane Jr., keynote speaker, with an acknowledgement of appreciation to the U.S. Army Foreign Science and Technology Center (FSTC) at Charlottesville, VA.

The FSTC, a field detachment of the Army Materiel Command, filled the ball room of the Army's historic Hotel Thayer at the Military Academy with an exhibit of hundreds of small models or full-scale reproductions of foreign military materiel. Acclaimed by viewers as one of the most complete and attractively presented exhibits ever displayed at an Army Science Conference, the display was mounted in handsome cases, several on revolving bases, designed by the FSTC and constructed by Tobyhanna Army Depot, PA.

Speaking on "Looking a Decade Ahead," LTG Deane addressed some of the major problems, as he views them, of achieving more effectively coordinated planning, programing and procurement of high quality materiel, designed to ensure technological superiority to offset the potential enemy's quantitative advantage in personnel and equipment resources.

LTG Deane prefaced his informal presentation, laced with humor, by discounting "rumors about me being a hardware man, not attuned to science and technology." He expressed himself as knowledgeable and "very proud" of the many outstanding achievements of Army R&D in recent years.

Army scientists, engineers and administrators of major scientific activities in the Army R&D establishment should make a much more intensive effort to get together with the users of military materiel in developing plans and designs for materiel, he emphasized.

The keynoter also advocated a policy of delegating very substantially increased decision-making authority for weapons systems componentry and end products to the major commanders—that is, decentralizing of decision-making to progressive levels.

AMC DEPUTY COMMANDER LTG Woodrow W. Vaughan is flanked on left by AMC Deputy for Laboratories Dr. Robert B. Dillaway, and on right by Frederick East, director, Royal Armament R&D Establishment. United Kingdom, and Brigadier D. E. Isles, director of Munitions, Britisb Embassy, Washington.

In effect, his message was "Get approval of your plans and projects. Then move out to get the job done most effectively to produce the kind of materiel and systems we need and can afford within budgetary constraints." Reports to upper echelons of management, he said, should be limited to the state of progress and major problems encountered.

LTG Deane advocated an in-house laboratories policy of more effective R&D salesmanship, that is, better communication within the over-all Army R&D community to direct attention to ongoing programs, envisioned objectives, significant advances and capabilities for high-quality research, development, test and evaluation.

With respect to the All-Volunteer Forces—not just the Army but the Air force, the Navy and the Marine Corps—he expressed confidence that the Army's long-established expertise in the behavioral and social sciences should be of great value in dealing with training problems to reduce time required and upgrade the quality of results.

BANQUET ADDRESS. Army Scientific Advisory Panel Chairman Lawrence H. O'Neill was introduced as the banquet speaker by Deputy Assistant Secretary of the Army (R&D) Charles L. Poor as toastmaster.

In discussing "Impressions of AMARC (Army Materiel Acquisition Review Committee)," Mr. O'Neill talked about his observations and some of his conclusions as a member of one of six AMARC teams, that on Science and Technology. He cited seven impressions:

- "The Army's long-held position that it needs a suitable set of its own laboratories so that it can be a wise buyer, so that it can stimulate militarily important R&D, and so that it can properly oversee the work of its contractors, is valid.
- "The idea of using government-owned, contractor-operated (GOCO) laboratories has very limited applicability but probably should be used in a few instances. In every case in which GOCO is applied, enough Army people, suitably qualified and situated, should be intermingled with the contractor's so that the option of firing the contractor remains a real one and not merely a theoretical possibility.
- "Every reasonable measure should be taken to enhance the interactions between laboratory people, R&D directorate people and TRADOC (Training and Doctrine Command) people. By this I mean, TRADOC people should live in the labs for significant periods. Laboratory and directorate people should stay in contact with FORSCOM (Forces Command) units, relying on TRADOC advice about where to go and what to look for.
- "The laboratories should vend their capabilities to program managers and others responsible for new systems, especially major ones—truthfully, of course, but with zeal that is not outclassed by that of the contractors.
- "The criterion for continuing or shutting down an Army laboratory should be that its value to the Army is obvious to a sensible and responsible officer or Department of the Army executive and not merely the wisdom of a live-or-die decision is doubtful, either way.
- "Army laboratories, with some few exceptions are good. Some are outstanding. The fact that they are not all poor is a near miracle in view of the massiveness and complexity of the governmental structure and decision-making processes that they must live within. . . .
- "The governmental size and complexity I have just mentioned does not result from anyone's villainy or stupidity. . . . The size and complexity of the governmental structure from which decisions and money must be obtained arise naturally, inevitably and inexorably from the reasonable beliefs of large numbers of organizations and people that they must faithfully discharge important responsibilities. . . .

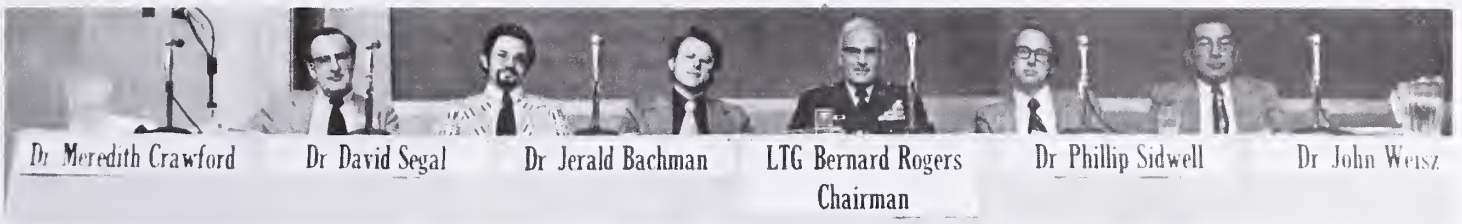
"Briefly stated, the penalty and notoriety that result from making a mistake in military procurement are so excessive that we have tried to insure ourselves against error at a premium that may exceed the face amount of the policy.

"The attitudes that make life tough in Army R&D," O'Neill continued, "extend all the way up, from laboratory to directorate, to command, to the Army Materiel Command, to the Department of the Army, Office of the Secretary of Defense, to the Office of Manpower and Budget, to the Executive Office of the President, to the Congress. And the attitudes deserve sympathy and care. Hand wringing about them is fruitless and unfair. . . ."

O'Neill stressed that the practice of making important decisions based on briefings must be halted. All important decisions, he contended, should be based on recommendations of the people "who live, day by day, with an R&D program. . . ."

As a "final impression from AMARC," he said the United States "owes a great debt to the people of their Army. Notable among them are the impressive officers, managers, professionals, technicians and assisting employes in Army R&D organizations. . . . I ask you to accept from me a most sincere 'thank you' and to carry it back to your colleagues."

PANEL DISCUSSION. Army Deputy Chief of Staff for Personnel LTG Bernard W. Rogers made the leading presentation



ASC Panel on 'The Volunteer Army's Investment for the Future.'

and presided as chairman of the 6-member panel discussion on "The Volunteer Army's Investment for the Future." Fiscal Year 1975 will be the most difficult year in achieving the recruitment goals of the volunteer Army, he said.

General Rogers was emphatic in stating that the volunteer Army is maintaining traditional standards for highly motivated, trained and thoroughly professional personnel. About 80 percent of those enlisting into the Army are retained after a rigid screening-out process during training.

Discussion during the questions and answers session following the presentations by panel members provoked some lively exchanges of viewpoints regarding the composition of the volunteer Army, the quality of some of the volunteers, certain policies (particularly those relating to hair styles), effectiveness of training, disciplinary standards and other aspects.

(Special treatment of some of the panel presentations with respect to the important role of the Army Research Institute for the Behavioral and Social Sciences (ARI) is planned for the September-October edition of the Army Research and Development Newsmagazine.)

Panel members were Dr. John D. Weisz, director, U.S. Army Human Engineering Laboratory, Aberdeen (MD) Proving Ground; Dr. Meredith P. Crawford, president, Human Resources Research Organization (HumRRO), Alexandria, VA; Dr. Jerald Bachman, Institute for Social Research, University of Michigan; Dr. Phillip Sidwell, director, Advanced Management Program, School of Business Administration, Georgia State University; and Dr. David R. Segal, chief, Social Processes Technical Area, ARI.

Acknowledgements. Assistant Secretary of the Army (R&D) Norman R. Augustine, in remarks prefacing his presentation of the awards, expressed his appreciation to the Army R&D community for maintaining high standards of professionalism and pride in R&D programs.

The Soviets have about 2½ times as many scientists and engineers as the United States, and they spend about $3 billion more annually than the United States for research, development, test and evaluation, and materiel acquisition, he asserted, adding:

"But I think we do have the edge in the general professionalism of our scientists, engineers and technicians, in their motivation for excellence, and in the quality of their results. The awards for technical papers at the Army Science Conference are strong testimony to the Army in-house RDT&E program."

Presiding Chairman Dr. Lasser expressed his appreciation to Dr. Craig Crenshaw, Army Materiel Command chief scientist, for his long service to the Army Science Conference, in a planning capacity as well as a session chairman for each of the ASC since the conference was initiated in 1957. Dr. Crenshaw retired effective June 30.

U.S. Military Academy Superintendent LTG William A. Knowlton, programed for introductory remarks as host, necessarily turned that responsibility over to BG William R. Feir when he was called to testify before a hearing in Congress on the volunteer Army, particularly use of women in combat.

Instead, LTG Knowlton, who will depart soon for another assignment, attended the final general session to express his greetings, congratulations to the Army R&D community for maintaining standards of excellence, and his appreciation for continuing to hold the ASC at the USMA continuously since the first assembly in 1957.

ADVISORY COMMITTEE. Arrangements for the 1974 Army Science Conference were made by an Advisory Committee headed by Dr. I. R. Hershner, deputy, and scientific director, Army Research, Office of the Chief of Research, Development and Acquisition, HQ DA; COL Francis C. Cadigan Jr., director of Medical Research, Medical R&D Command, Washington, DC; Dr. Gilford Quarles, chief scientific adviser, Office of the Chief of Engineers; Dr. Craig M. Crenshaw, chief scientist, Army Materiel Command; and Dr. Syney J. Magram, project officer, Army Research Office.

Coworkers credited with contributing to the success of the conference included Anne G. Taylor as over-all coordinator, assisted by Miss Lenette Glenn, both of the Army Research Office, Durham, NC; LTC Turner D. Griffin, project manager for the U.S. Military Academy, assisted by CPT John T. Scoffield Jr., Maj Robert W. Tasket and M/SGT Michael Biskup and LTC Kenneth Offman, the latter in the role of USMA Communications-Electronics Officer.

RIA Cuts Costs With New Forging Technology

A new forging technology, which enables complex-shaped, high-performance weapon components to be produced at a quality level equal to conventional forging but at a significant cost saving, has been applied to the centuries-old powder metallurgy process at Rock Island Arsenal (RIA), IL.

Called "powder-metal hot-forging using minimum deformation techniques," the process consolidates certain aspects of the metal forging process and the powder-metal compaction-sintering process into a logical extension of both.

The material used in the process at the RIA Rodman Laboratory is a high-quality, prealloyed metal powder resolving the chemical inhomogeneity problems inherent in the blended elemental powders of the old powder-metal processes. In the new process, the metal powder is conventionally pressed and sintered to a shape geometrically similiar to the final part. It is then hot-forged to near theoretical density to relieve its susceptibility to brittle failure.

Conventional powder metallurgy processes involve putting granulated metal powder in complex die cavities, thereby minimizing metal waste and subsequent machining. However, conventional powder metallurgy products are generally identified as porous or semiporous materials lacking homogeneous structures. They are prone to brittle failure under highly stressed service environments.

The mechanical value of items made by the new powder metal forging process have been found to be comparable to that of the barstock forgings. The ability of the material to withstand stresses is due to the extremely uniform, fine-grained microstructures of the forged powder-metal products.

The usefulness of the developed powder-metal forging process was demonstrated in the production of the accelerator for the M85 .50 caliber machinegun. The accelerators were endurance tested at Rock Island Arsenal, and exceeded all requirements in the standard room-temperature tests. The accelerators also withstood the test firing of more than 10,000 rounds at –65° F. No failures were experienced. It was also found that the forged powder metal accelerators can be produced at a cost estimated at 75 percent less than that of the conventionally forged component.

A Military Specification for prealloyed powder metal forgings has been drafted and accepted by the Department of Defense and commercial organizations. This new technology is currently being implemented for production of military weapon systems components. It has been estimated that 24 components of the M85 weapon can be made using this technology. Analysis of powder-metal production of components for the M16 is being accomplished.

The program was conducted by Joseph DiBenedetto of the Rodman Laboratory, and F. T. Lally and I. J. Toth of TRW, Inc., Cleveland, OH.

Metallurgist Ferrell Anderson performs the slow deformation forging of a powder-metal preform of the accelerator for M85 machinegun, on 250-ton hydraulic press.

National, International Interests Focus On . . .

NLABS Enzymatic Conversion Process to Alleviate Energy Problems

National and international interest has focused increasingly on the U.S. Army Natick (MA) Laboratories in recent weeks. Congress is viewing the long-range potential of an experimental NLABS enzymatic process of converting millions of tons of cellulose waste annually into clean-burning fuel and into glucose food products or short-supply chemicals.

Senator William B. Proxmire conducted three days of public hearings (May 20-22) before the Subcommittee on Priorities in Government, Joint Economic Committee, to listen to three Natick Laboratories scientists and engineers describe the enzymatic conversion process. They explained its potential for contributing to alleviation of the nation's long-range energy problems, and the purpose of an experimental NLABS pilot plant which began operating in June.

Director of the Federal Energy Office John Sawhill and Director of the Environmental Protection Agency Russell Train participated in the presentations and discussions, along with representatives of major oil companies, in probing the question of developing a clean-burning fuel to minimize pollution from the nation's vehicles.

Consumer advocate Ralph Nader and Clarence Ditlow of his Public Institute Research Group made presentations, as did Lyle P. Schertz of the Economic Research Service, U.S. Department of Agriculture; Dr. Thomas Reed, Energy Laboratory, Massachusetts Institute of Technology; Dr. David Wilson, MIT Department of Engineering; Dr. Aaron Altschul, nutrition expert of the School of Medicine, Georgetown University; Jerry Berger, research engineer, Shell Oil Co.; and Dayton Clewell, Mobile Oil Co.

Natick Laboratories Pollution Abatement Program Manager Leo Spano, internationally known research scientist Dr. Mary Mandels and brilliant young Dr. John R. Nystrom, 28-year-old chemical engineer who designed, directed the installation and is managing the pilot plant, described their activities. They explained their teamwork, along with other Natick researchers, to develop the enzymatic conversion of pollution problem waste products into many profitable materials.

Senator Proxmire scheduled the hearings after a press announcement expressing his confidence in the promising prospect of applying the new Natick Laboratories technology, on a massive scale, to the long-range (1980s) national objectives. The plan calls for recycling waste products into useful derivatives through a resources recovery program. The conference followed a thorough preliminary study by his staff of the NLABS system.

Spano told the subcommittee that the NLABS were directed by the parent U.S. Army Materiel Command July 1, 1971, to add to their basic mission—that of providing for the effectiveness and well-being of the American soldier by development of "the best clothing, feeding and protective systems for operations anywhere in the world"—studies that would lead to practical pollution abatement processes.

The Army Materiel Command action came in response to requirements of the National Environmental Policy Act of 1969, Public Law 91-190, and the Presidential Executive Order No. 11507, dated Feb. 4, 1970, on prevention, control and abatement of air and water pollution at federal facilities.

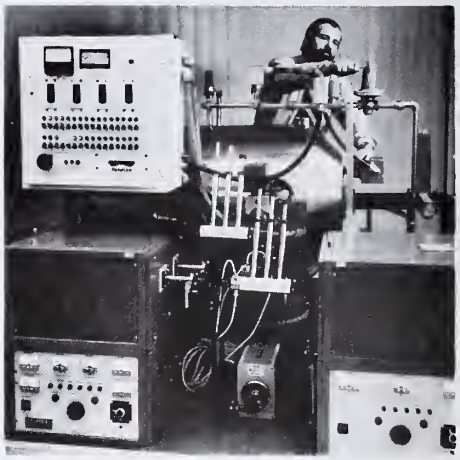
The magnitude of the U.S. Army problem, Spano informed the subcommittee, was attested in 1972 by a requirement to dispose of about half a million tons of trash. Most was buried.

The Environmental Protection Agency has estimated U.S. accumulation of trash in 1973 at 130 million tons—enough to fill garbage trucks that, if lined up bumper to bumper, would stretch from New York to Los Angeles, three abreast.

Pointing to the potential for applying the Natick Laboratories enzymatic conversion technology to this problem—hopefully by successful results of the pilot plant program for about 18 months, leading to a demonstration plant capable of processing 200,000 pounds of trash monthly—Spano told the subcommittee:

"Cellulose is the world's most abundant organic compound with an annual net yield from photosynthesis estimated at 100 billion tons. This is approximately 150 pounds of cellulose per day for each and every one of the Earth's 3.7 billion people.

"Furthermore, it is annually replenishable. The energy to produce this vast quantity of cellulose comes from the sun and is fixed by photosynthesis. Much of the cellulose ends up as waste, particularly in municipal trash (40-70 percent), animal feed lots, wood waste and agricultural waste."



AUTOMATED OVEN combining microwave energy at two frequencies, infrared heating elements, and a steam pressure cooker is being used in a research program to determine optimum methods and times for roasting of meats.

After describing in detail the process for enzymatic conversion of cellulose waste to useful products—on a profitable basis as opposed to the current high cost of trash removal and disposal, estimated over-all as high as $35 to $40 a ton in addition to the pollution and land-fill problems—Spano explained to the Senate group:

"The key to this process is the production of high-quality cellulase (the enzyme that dehydralizes cellulose) from *Trichoderma Viride*. To date we have defined the conditions needed to produce the enzyme in quantity. We have also developed mutant strains that produce two to four times as much cellulase as the wild strain. In this area, we feel that we have yet to reach the upper limit."

When first announced publicly to the *Army Research and Development Newsmagazine's* then 60,000 copies monthly audience in a page one article in the April-May 1971 edition, the enzymatic conversion process was qualified as a most promising new discovery.

In the following months that early limited optimism was revised progressively until it became "potentially the most significant basic research result in the history of the Natick Laboratories," a history of many achievements of worldwide importance.

Before the "Energy Crunch" changed dramatically the American quality of life affluency standards, during the distressing winter of 1973-74, Dr. Carl Lamanna cited the potential for production of methane, ethane, alcohol and other fuels from cellulose waste.

Writing then as deputy chief of the Life Sciences Division, U.S. Army Research Office, Office of the Chief of R&D, Dr. Lamanna authored an article outlining this possibility in the July 1972 *American Society for Microbiology News*. The article was reprinted by permission in the September 1972 *Army R&D*

EMERGENCY REPAIR SHELTER (CH-47), developed by NLABS, is shown during evaluation tests by the U.S. Army Test Center headquartered at Ft. Greely, AK. The U.S. Army Aviation Test Board, Fort Rucker, AL, also completed cold weather testing of the shelter at the Climatic Laboratories at Eglin Air Force Base, FL., in joint effort.

Newsmagazine under the headline: "Profiting From Use of Trash—Conversion of Waste Material to Antipollution Fuel."

Natick Laboratories leaders have learned since the Proxmire hearings that major news media (CBS and ABC TV nationwide, along with magazines and metropolitan newspapers, including some from foreign countries) are now eager to publicize the enzymatic conversion process. Newsmen have become almost daily visitors to interview NLABS Commander COL Harry Corkill, Technical Director Dr. Dale H. Sieling, Mr. Spano, Dr. Mandels and Dr. Nystrom.

Placed in its proper background, however, the enzymatic conversion process (ECP) must be regarded as one of those totally unforeseen benefits to the civilian community of basic research to meet a U.S. Army problem of truly staggering proportions.

ECP is a serendipitous spinoff of a World War II problem, that of microbial deterioration of U.S. military materiel and equipment, estimated at billions of dollars annually, when exposed to severe biological environment anywhere in the world.

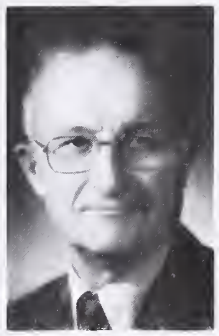
Efforts to alleviate this problem have led NLABS into the isolation, culture and maintenance of more than 12,000 strains of microorganisms (fungi) associated with the biodegradation of military supplies. Unique is a proper word, that is, one of a kind in the world, when applied to this collection and to the scientific expertise in this area of NLABS researchers. The man who heads this effort is Dr. Emory G. Simmons.

Consequently, when the problem arose of accomplishing the mutation of fungi to be "super consumers" of cellulose trash in the ECP, the technology was "on the shelf" at NLABS. Still the task has required about 10 years of patient effort—with the goal ahead of doubling or (most optimistically) quadrupling the mutation progress to date.

Certainly if current goals of the ECP team materialize fully, the process will become of profound importance, nationally and internationally. Meanwhile, as Dr. Mary Mandels stated in addressing the 12th National Junior Science and Humanities Symposium May 17, 1974, their hopefulness is that of "cautious confidence."

Dr. Elwyn T. Reese, under whose guidance Dr. Mandels achieved national fame and who has since carried on much of his fundamental research, following his retirement as one of the noted NLABS' research enzymologists,

COL Harry Corkill
NLABS Commander



Dr. Dale Sieling
NLABS Technical Director

isolated the enzyme now used in the ECP. World renowned, he was invited by Pope Paul to attend the Vatican Scientific Conference as the U.S. Department of Defense representative.

Discussing the long-range ECP possibilities with an *Army R&D Newsmagazine* staff member following his presentation to the Senate subcommittee, Spano commented:

"From a demonstration plant processing of 200,000 pounds of cellulose waste a month, the NLABS team hopes to derive about 100,000 pounds of glucose products. The syrup can be made into sugar. It can be used to grow yeast on it as a single-protein food. It can become a drinkable alcohol or it can be used to make a solvent such as acetone and other chemicals.

"There is no reason," as I view it, "why we could not make antibiotics, vitamins, gluconic acid, plastics, ethylene, polypropylene and a great variety of other useful products. Even the residue from the conversion process, when dried and formed, might be burned as a low-grade form of coal."

Vastly beneficial as the ECP conceivably may become, it will compete for No. 1 ranking in NLABS all-time great R&D achievements with many results that have firmly established claim to prideful international recognition.

In October 1973, for example, the Packaging Institute of America presented to NLABS a special award, the first of its kind, at the PIA's 35th annual Packaging Forum.

The award honors the flexible packaging system for thermo-processed foods, which has been acclaimed, among accolades from many nations, as "without a doubt the greatest achievement in food packaging in the last century . . . as revolutionary as the development of canned food for Napoleon's Army by Nicholas Appert over 100 years ago."

NLABS' scientists and engineers responsible for this long-continued R&D program were cited by the PIA awards committee for "foresight, creativeness, leadership and outstanding achievements in the field of packaging."

Laboratory and field tests have demonstrated the flexible package can withstand shipment and storage as well as the tin can, and that it "far exceeds military requirements for stability (up to 8 years at 70°F. and 6 months at 100°F.)."

Contracts with Swift & Co., Pillsbury Co., Continental Can Co., FMC, and Rexham Corp. have proved that flexible packages, sized to fit into the pocket of a field soldier's uniform, can provide a variety of improved rations produced at a reliability equivalent to canned foods.

Accepted by NASA and used in the Apollo space flight program since December 1968, the new packaging system is a commercial reality in Japan and Europe (based on NLAB R&D results) and is expected to be used commercially in the United States within two years.

Most of the foods used on the Mercury, Gemini and Apollo space flights were developed in-house by the NLABS Food Laboratory staff, with ration design specialist Mary V. Klicka gaining worldwide prominence.

IRRADIATION PRESERVATION OF FOOD, a technology pioneered by NLABS, has had worldwide impact in the United Nations food for peace program as a part of the U.S. program for peaceful use of atomic energy. The NLABS' cobalt-60 source is the largest of its kind in the world.

Radiation Preservation of Food, prepared by the U.S. Army Quartermaster Corps and issued in August 1957 as the first publication in the prestigious Army Research and Development Monograph Series, became a 461-page document of worldwide interest.

DEPARTMENT OF DEFENSE FOOD PROGRAM. Management of the Department of Defense Food Research, Development, Test and Engineering Program has been an assigned responsibility of NLABS since Oct. 24, 1969, under the leadership of Dr. Edward E. Anderson.

Facets of a 5-year "Department of Defense Food RDT&E Program" were detailed at the 85th Joint Medical Research Conference at the Pentagon, Washington, DC, in February

(Continued on page 18)

Leo A. Spano
Pollution Abatement Program Manager

Dr. Mary Mandels
Research Scientist NLABS

Dr. F. P. Mehrlich
Director Food Engineering Lab

John V. E. Hansen
Director CE&ME Laboratory

Dr. S. David Bailey
Director Food Sciences Lab

National, International Focus On . . .

NLABS Enzymatic Conversion Process

(Continued from page 17)

1970. The mission: To integrate all activities of the Armed Forces in food processing, packaging and preservation, in accordance with DoD Instruction 3200.10.

A Joint Service Regulation in 1971 established a Joint Formulation Board comprised of a voting member from each service. The Army Surgeon General was designated the Executive Agent for Nutrition and a Joint Technical Staff, comprised of Army, Air Force, Navy and Marine Corps members, was functional at NLABS by the end of 1971.

Results of the DoD Food Program to date include Technical Report 73-10-OR/SA, August 1972, based on an extended study at Fort Lewis, WA, titled "A Proposed Modern Food Service System," and Technical Report 73-20-OR/SA, December 1972, titled CAFe (Centralized Army Feeding System)," also based on the Fort Lewis study. Both reports were prepared by the NLABS Operations Research and Systems Analysis Office.

A similar NLABS preliminary report has been issued on "Experimental Evaluation of the Modular Fast Food Service Operations at Travis AFB." The Fort Lewis study was reported in detail in the March-April 1972 edition of the *Army R&D Newsmagazine,* page 8, titled "Troops List Their Food Choices."

Determinations and implementive results of these reports are effecting profound changes in the types of food, service and dining room environment for members of the Armed Forces. Future Newsmagazine articles will describe many of the more significant changes, based on preferences of troops.

The NLABS OR/SA Evaluation of Army Garrison Feeding has provided the basis for central preparation and freezing of food, transportation to and reheating and serving in unit dining halls, and central warewashing. Several versions of large (80,000 square feet) central food production facilities for major military installations have been designed.

Plans for a $120 million construction program to build 12 of these facilities in five years point to a potential saving of $40 to $50 million annually in operating costs, while at the same time offering improved food serviced to Army customers.

Reporting on his role as NLABS special assistant for the DoD Food Program, Dr. Anderson authored a long feature article titled "Feeding the Military Man" in the June 1972 edition of *Club and Food Service News.*

The article describes the NLABS Food Laboratory role in developing foods for "specialized military situations," including requirements of each of the military services, and the upgrading of all food products and feeding systems.

Dehydration of field rations to alleviate the logistics problem through freeze drying and other techniques to reduce the weight and greatly compress the food items are discussed. Freeze-dried peas, for example, have been compressed at least fourfold in weight and volume, but when reconstituted are favorably comparable to fresh peas.

The Long Range Patrol Food Packet, offering a variety of palatable and nutritious foods to the field soldier, was the first ration to use freeze-dried products.

Thermostabilized wet food products in flexible packaging are being developed in considerable variety by the NLABS Food Laboratory and are still under intensive study for troop acceptability. Some of the products include frankfurters, beef and gravy, and meat balls in sauce.

OVER-ALL PROGRAM OBJECTIVES. Research, development and engineering goals, facilities and capabilities of the NLABS reach into a great variety of mission areas to improve the soldier's combat effectiveness--by sustaining and protecting him in all environments, beginning with the battlefield.

An awareness of the scope and depth of the over-all program is stimulated by a tour through the impressive array of sophisticated equipment in the laboratories and briefings by the highly experienced professional staff.

Statistics also contribute to that understanding. NLABS improvements or innovations of equipment have totaled more than 1,100 items during the past decade. Involved is an investment of some $290 million in research, development and engineering. Results have led to procurement contracts with industry for roughly $19 billion.

Major RDE customers of the laboratories in activities leading to procurement contracts include key agencies of the Departments of the Army, Air Force and the Navy plus the Marine Corps and the Defense Supply Agency.

About 80 percent of the current NLABS preparation of some 2,300 technical documents pertains to specifications maintained under the DoD Standardization Program through the Defense Supply Agency. Roughly 15 percent of the documents support the GSA, with the remaining 5 percent originated by the Troop Support Command (TROSCOM) and the Army Aviation Systems Command (AVSCOM).

Climatic chambers available to NLABS scientists and engineers for experiments to simulate environments in all parts of the world include an arctic facility where temperatures to minus 70°F. and winds to 40mph can be produced.

A tropic chamber creates temperatures as high as 165°F. The raincourt chamber capabilities range from misting to a torrential downpour and the fire test facility is used for exposing items of clothing and equipment to experimentation. A laser beam facility serves for the study of camouflage dyes, pollution abatement research and other activities.

Additional facilities include a nuclear magnetic resonance spectrometer for determining molecular structures of organic compounds; a linear electron accelerator for a sophisticated food processing system; a third-generation Univac 1106 computer to assist in solving technical and management problems; a water tank for measuring heat transfer between the human body and the water at controlled temperatures; and a high altitude chamber where conditions up to 45,000 feet can be created.

The altitude chamber, water tank, a treadmill to study effects of work stress military situations in the field such as heat, cold and altitude, and various other test facilities are a part of the U.S. Army Research Institute for Environmental Medicine. USARIEM is an NLABS tenant activity of the U.S. Army Medical R&D Command, Office of the Surgeon General.

POSTURE STATEMENT, FY 1973. This document shows that during 1973 the NLABS used a majority of its resources in support of four major program areas, namely: DoD Food RDT&E Program, Personal Armor Systems R&D, Pollution Abatement in the Army, and Airdrop Engineering Systems.

Until a Reorganization became effective July 1, 1974, these programs were conducted with the resources of five major laboratories: Airdrop Engineering; Clothing and Personal Life Support Equipment; Pioneering Research; General Equipment and Packaging; and the Food Laboratory. Additional elements included an Equipment Management and Support Services Office, and a Quality Assurance and Engineering Office.

The New Organization consists of an Aero-Mechanical Engineering Laboratory (director unannounced at press time); Clothing, Equipment and Materials Engineering Laboratory, headed by Dr. John V. E. Hansen; Food Engineering Laboratory under leadership of Dr. Ferdinand P. Mehrlich; and a Food Sciences Laboratory under Dr. S. David Bailey. Other elements are an Engineering Programs Management Office, headed by Edward F. Levell, and a Technical Documentation Office (chief unannounced at press time).

NLABS Funding in FY 73 totaled $34,137,000 of which $22,571,000 was spent for RDT&E, $1,386,000 for procurement, and $10,180,000 for operations and maintenance. Funding for RDT&E was about the same as for FY 72, $21,973,000.

Manpower resources as of July 1, 1974, following a cutback in line with the DoD economy program, totaled 1,286, which includes professional scientists, engineers, technicians and scientific management personnel. Of these 95 had PhDs, 144 master's and 240 bachelor's degrees. Civilian employes totaled 1,167 and military 119.

Major Accomplishments listed in the FY 73 Posture Statement include type classification of an extraction force transfer coupling for

TWO-MAN MOUNTAIN TENT, developed by NLABS, is scheduled for some extra testing this summer when SP4 Gilbert Smith (left) and SP4 Tom Anderson take the tent along on a 2,000-mile Appalachian Trail hike from Mount Katahdin, ME, to Springer Mountain, GA. Plans for the four-to-five-month trek took shape when the avid backpackers, assigned to the laboratory's Sudbury Annex Meteorological Team, assisted NLABS scientists with some preliminary testing. The hikers will mail reports along the way, giving the Army scientists a running evaluation of the tent's performance.

cargo airdrop operations; a versatile new load-carrying system to meet all the infantryman's varying needs based on mission and environment; development and adoption of synthetic fur as a replacement for wolverine fur, and the subsequent elimination of the use of natural fur for military use.

Listed also is a quick-release universal buckle for use on load-carrying equipment and body armor; improved rations including new portion-controlled beef roasts and steaks; development of an improved veal product to replace the present 3-way fabricated veal (portion cut slices, roasts and ground veal); and reversibly compressed foods to achieve "drastic reduction of food volume and attendance packaging, storage and transportation costs without diminishing the quality or acceptability."

Additional accomplishments included Skylab Bread to satisfy NASA's requirement for 2,000 units which would keep at least one year without refrigeration; design of flexible packaging systems in lieu of metal cans for operational rations; detection of dyed camouflage and other luminescent systems; and the Centralized Army Feeding System (CAFe).

Publications, Presentations and Patents listed in the Posture Statement fill 21 pages, indicating the broad scope of NLABS RDT&E.

Technical Library holdings are comprehensive, including more than 45,000 bound volumes of books and journals, about 1,000 current subscriptions to periodicals and other media, and over 50,000 technical reports (about 18,000 on microfiche).

Achievement Awards announced in May 1974 included Commander's and Technical Director's Awards to 10 in-house personnel.

Development of an improved head measuring device which aids in providing data for new helmet designs earned a Technical Director's Gold Pin for engineering for Dr. William D. Claus, Philip E. Durand and Lawrence R. McManus. All were assigned to the Clothing and Personnel Life Support Equipment Laboratory (C&PLSEL).

Research achievements merited the Technical Director's Gold Pin for Dr. Roy C. Laible and Maurice R. Denommee, C&PLSEL. They were cited for joint development of fiber material for utilization in ballistic protection research for helmets and armor.

Technical Director's Silver Pins were presented to Robert D. Jarrett Sr., Food Laboratory, for enlarging and improving the research and production irradiator for the Army and the National Food Irradiation Program. Gerald L. Schulz, General Equipment and Packaging Laboratory, was likewise honored for improvements in bonding flexible food packages.

Commander's Gold Pin recipients for administrative accomplishments were John R. Mullen, civilian personnel officer, and Albert P. Sobiewski. Mullen was cited for advancing human relations and equal opportunity programs. Sobiewski was recognized for his work with the RD&E contract program. CW3 Robert J. Kiely, Airdrop Engineering Laboratory, received the Commander's Military Award for design of a parachute harness.

Special Mention under the heading of awards for this article necessarily must be made for three NLABS veterans. Frank Rizzi, the diminutive human dynamo who heads the Textile Research and Engineering Division, has over the years received just about every honor that can be accorded him.

His most recent recognition (1973) is the Decoration for Meritorious Civilian Service for his development of a coloring system that can simultaneously defeat the image-intensifier and the sniperscope.

Similarly honored were Dr. Louis Long, Jr., for his studies in the chemistry of flavor, toxic substances in food stuffs and research in carbohydrate chemistry, and Mr. Allan J. McQuade for his expertise in the development of fire-resistant treatments, fibers and clothing for protection of aircrewmen and combat vehicle crewmen.

In addition, Mr. Frank Rubinate and Dr. Rauno A. Lampi received the same high recognition for their work in developing the flexible packaging of food concept.

HISTORICAL BACKGROUND. Selection of the site of the Natick Laboratories, 18 miles west of Boston on an original 100-acre beautifully forested site almost surrounded by fresh water Lake Cochituate, is interlaced with unusual controversy.

Dr. Dale H. Sieling, who became the second technical director in 1959 when he succeeded Dr. Stuart Hunter and has since been a persuasive force in NLABS planning, programing and all aspects of operations, recalls that 284 cities submitted site proposals. A Department of Defense committee selected the site after seven months of inspecting the foremost competitive sites.

Although the Commonwealth of Massachusetts reportedly donated most of the land for one dollar, an inducement not to be rejected, good transportation facilities and proximity to outstanding educational institutions, libraries and commercial research establishments were among favorable factors. In 1973, NLABS surrendered 22 acres to the Commonwealth of Massachusetts for a possible future wildlife and ecology center.

Public Law 424 enacted by Congress authorized, on Oct. 28, 1949, the construction of a Quartermaster Research Laboratory at Natick and appropriated $11 million for this purpose. Groundbreaking ceremonies Apr. 19, 1952, were followed that November by the starting of construction of 7 principal buildings.

Dedication ceremonies Oct. 14, 1954, attracted about 1,100 guests including U.S. Government, academic and industrial leaders and military representatives from the United Kingdom and Canada. The Secretary of the Army gave the principal address.

LUNCHING on Canadian Forces Combat Rations inside an Arctic tent, Albert A. Carletti, NLABS, and MAJ John G. Evans, of the U.S. Army Scientific Group-Canada.

The Quartermaster Research Laboratory was renamed the Quartermaster R&D Center Oct. 1, 1953. The QM R&D Command was established the same date, also as a Class II Activity under jurisdiction of The Quartermaster General, in recognition of Applications Engineering and Standardization Programs.

The Army-wide reorganization in 1962 placed the QM R&D Center under the jurisdiction of the newly established Army Materiel Command, effective July 26. The center was redesignated June 20, 1963, as the Natick Laboratories by Department of the Army General Order No. 27. The Armed Forces Food and Container Institute in Chicago was deactivated Aug. 30, 1963, and moved to the NLABS.

Transfer of control of the NLABS from the Army Materiel Command to the Troop Support Command (TROSCOM) became effective July 1, 1973.

Looking to the future, Dr. Sieling foresees NLABS continuing to play a critically important role, saying: "Our primary concern at Natick Laboratories is to sustain an effective military man under all conditions. What he eats, carries, and protects himself from, is part of our total commitment."

Federal Agencies Report on Suppressive Shielding Concept

Suppressive shielding, also termed the "Venting Wall Concept," to improve structural safety and minimize destruction during accidental explosions in hazardous assembly operations at Army ammunition plants, has stimulated interest of 40 federal agencies.

Representatives of more than 20 nonmilitary federal agencies and of the Army, Navy and Air Force attended a recent 2-day symposium at Aberdeen (MD) Proving Ground. They exchanged ideas and received updated information on the concept. Dr. David J. Katsanis, chief of the Edgewood Arsenal Hazardous Materials Engineering Office, presided.

Edgewood Arsenal, now a tenant of the APG, has been developing the concept for about 10 years. Advances reported during the past two years have gained recognition for the suppressive shield as a significant discovery in the area of explosives safety.

Tests utilizing the technique have been conducted during hazardous materials operations involving pyrotechnic and propellant explosives, ranging from components as small as primers to melt kettles over 2,500 pounds.

Featured during the recent symposium were technical presentations on suppressive shielding technology by APG scientific personnel at Edgewood Arsenal, the Army Ballistics Research Laboratories and the Army Materiel Systems Analysis Agency.

Earlier this year the Army announced it had approved the suppressive shielding concept for selected operations on assembly lines producing 81mm projectiles at Army ammunition plants in Milan, TN, and Texarkana, TX.

Developments have also been reported in applying suppressive shielding technology to safety problems in explosive ordnance disposal operations. Design, fabrication and tests on a prototype transportable suppressive structure were favorably completed for the Naval Explosive Ordnance Disposal Facility at Indian Head, MD. Suppressive shielding is based on the principle of venting and diffusing overpressures at a controlled rate to permit the gases to be dissipated without harmful structural effects.

One of the researchers on the shielding concept said it applies the wisdom of an old Chinese proverb: "It is better to bend with the wind than to be torn up by the roots."

Comparative Assessment . . .
U.S. Army/USSR Ground Forces Materiel Acquisition Processes

By David Brinkley

The U.S. Army Foreign Science and Technology Center, An Army Materiel Command element at Charlottesville, VA, is concerned with continuing collection and analysis of information pertaining to how capabilities and the R&D processes of the potential enemy compare. This article is one of a series being prepared for publication in the Army R&D Newsmagazine. Author David Brinkley has served with the FSTC since 1970 as a specialist on Soviet RDT&E management, following duty with the Air Force as an officer in the Foreign Technology Division. He did graduate work in Soviet government and politics at Duke University

The U.S. Army Research and Development community maintains a reasonably high level of interest in how its Soviet counterpart does business, from two different but related standpoints.

The first concern is a "threat" perspective, which is a prerequisite to providing adequate response and insuring logical continuity in our own R&D programs. The second view is an "importation" perspective, involving features/practices of the Soviet R&D process which can and should be employed to help reduce U.S. R&D costs.

Questions have been raised in recent months about our ability to compete favorably with the Soviet military materiel research, development, test and evaluation policies and procedures. Concern is being expressed in some quarters that in this competition the U.S. may be pricing itself out of the market—that inherent in Soviet R&D management are features which automatically help to keep the cost of major weapon systems to an absolute minimum without compromising operational performance.

The purpose of this article is to make an assessment comparing the R&D management structures and decision processes of the United States and the USSR, in an attempt to shed light on how we stand *vis-a-vis* the Soviets.

GENERATING THE REQUIREMENT. Within both the U.S. Army and the Soviet Ground Forces, a major weapon system requirement can be generated by any "responsible" element or individual. In practice, however, such requirements (for tanks, artillery, rockets, etc.) and subsystems are generated primarily by organizations through formalized processes and procedures.

Figure 1 shows those U.S. and Soviet elements responsible for drafting/staffing Required Operational Capabilities (ROC) and Tactical Technical Requirements (TTR).

In the United States, the drafting of a ROC is usually a joint venture between the Army Materiel Command's six commodity commands, which provide the technical assessment, and the Training and Doctrine Command (TRADOC) proponent schools, where faculty members provide inputs on need, time frame, and organizational concepts.

In the USSR, the materiel developers are not part of the military establishment; they provide feasibility studies related to TTRs, but do not play as central a role, as does the Army Materiel Command, in generating requirements.

After the U.S. TRADOC validates a ROC, it is forwarded to the Deputy Chief of Staff for Operations and Plans (DCSOPS) and the Army Chief of Research, Development and Acquisition (CRDA). The U.S. Army approach seeks to make the ROC generating process simpler and less time-consuming by abolishing certain organizational and bueaucratic barriers and bringing together in TRADOC those elements which develop system requirements.

Soviet Ground Forces TTRs, in contrast, are generated and sponsored by each of several relatively autonomous, parochial

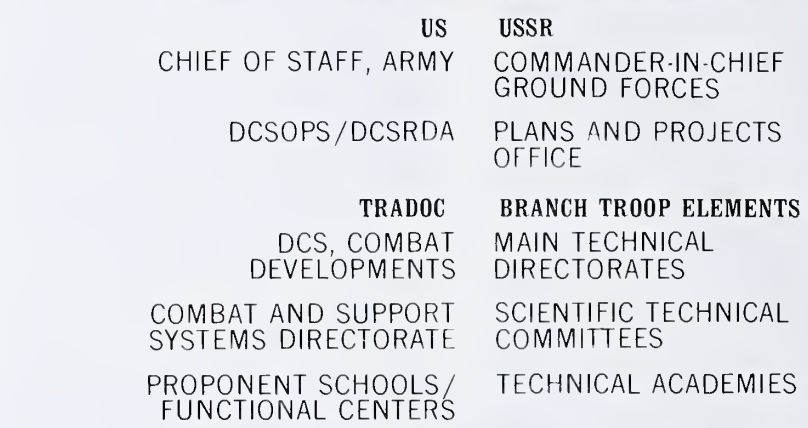


Fig. 1. U.S. and USSR Requirements Generating Elements. At the Army staff level, the Deputy Chief of Staff, Operations and Plans (DCSOPS), and the Chief of Research, Development and Acquisition (CRDA), review and validate ROCs approved by the Training and Doctrine Command (TRADOC). DCSOPS validates need on the basis of forces and operational concepts, strategic planning, etc. The CRDA looks at the uniqueness of the proposed program and determines resource availability. In the Soviet Union, it is believed probable that similar considerations are within the purview of the Plans and Projects Office, Ground Forces Headquarters.

branch troop elements (e.g., Main Armored Troops, Main Rocket and Artillery Troops, etc.). These elements are analogous, in some respects, to the pre-1962 U.S. Army Technical Services. Each branch troop element has a main technical directorate and a scientific technical committee (NTK) which define needs and draft TTRs. Directorate and NTK personnel (customers) interact frequently with Soviet industrial R&D facilities (developers).

In both countries, the military schools and academies support the requirements process, although the U.S. Army's proponent schools play a much larger role than do the Soviet Ground Forces technical academies.

While the U.S. Army has opted to put these institutions under one command, the Soviet Ground Forces continue the policy of subordinating the most important schools and academies to individual branch troop elements.

Each of the Soviet military technical academies (e.g., the Military Academy of Armored Troops, Moscow) performs research in support of TTRs and also trains officer engineers to fill positions within the main technical directorates and NTKs. Many of these officer engineers become quality control monitors of R&D in industry.

On balance, the requirements generation processes of the two countries are quite different. The U.S. Army stresses centralization of the ROC development function, whereby one command generates and integrates major weapon system requirements for the users.

Most of this activity is performed at relatively low levels within TRADOC, by company grade and junior field grade officers at the schools and within TRADOC system-category divisions and branches.

Within the Soviet Ground Forces, TTRs for specific categories of weaponry are generated by separate branch troop elements, headed by general officers whose lengthy tours of duty and strong branch troop loyalties help to guarantee a fairly high level of success in getting requirements approved.

The Soviet rationale seems to be that the chances for getting approval are greater if, as is the case, the tank generals represent an institution which generates armor requirements, monitors R&D in industry, and performs acceptance testing.

The U.S. Army ROC generation and approval cycle possibly takes less time than does the USSR Ground Forces cycle. The Army Chief of Staff (CSA) has approval authority for a ROC. His counterpart, the Commander-in-Chief (CINC), Ground Forces, must review the requirements submitted by each of the main branch troop elements. Then his recommendations go to the Ministry of Defense General Staff, which reviews the requirements of all five armed forces—Ground, Naval, Air, Strategic Rocket, and Air Defense.

Ultimately, the Defense Minister, Marshal of the Soviet Union A. A. Grechko (U.S. Secretary of Defense James R. Schlesinger's counterpart) must choose between competing proposals for new or improved weapon systems. It is apparent that the Commander-in-Chief, Soviet Ground Forces, does not have the authority to approve a TTR. In this phase of the R&D cycle, the ROC is

subject to relatively low level approval, while the TTR must be approved by much higher levels within the military establishment.

In the United States, the decision to begin development is usually made at Department of Army level, subsequent to the drafting of a Development Concept Paper (DCP) and a Concept Formulation Package (CFP) by a Special Task Force under the supervision of Army staff elements. The task force expedites the processing of the CSA-approved ROC. For comparison purposes, the amount of time spent here must be added to that required to generate the ROC.

In the next phase of the total cycle for innovating and fielding materiel—design, development and test—the situation appears to be inverted; i.e., the U.S. process takes longer, and requires a higher approval level than does the Soviet process.

The Soviets appear to feel that, in general, if requirements are properly and painstakingly defined, documented, and then approved at the highest levels, risks are minimized and the development process itself will function more smoothly and efficiently.

MANAGING PROTOTYPE DEVELOPMENT. The Army Materiel Command (AMC), as the developer agency for major weapon systems, spent approximately one-third of its FY 1973 R&D dollars for in-house activities (excluding TECOM monies) and the remainder with industrial contractors. In the Soviet Union, the situation is completely different: The Ground Forces perform little in-house R&D; that which the branch troop elements do perform supports the development of TTRs. Design and development is the responsibility of civilian-headed and civilian-manned industrial ministries whose place in the government hierarchy equals that of the Ministry of Defense.

Stated simply, in the U.S. both the user and the developer are part of the military establishment; in the USSR, only the user is part of the military establishment. AMC's counterpart is the industrial ministry responsible for major ground weapon systems.

It begs the question to say that, even so, the Soviet government runs both the military and the industrial sectors. Throughout the R&D process, each sector has its own set of prerogatives, and neither is master of the other.

This means that the USSR has not had to deal with the problem of the developer dominating the requirement-generating agencies and processes, although the developer tries to influence the customer while the latter is drafting TTRs.

Both countries recognize that prudent and resourceful management is a key to shortening development time and decreasing costs. Where the U.S. and the USSR part company is *how* development programs are managed and controlled, and at what levels.

The U.S. exercises control through AMC project managers (PMs), the TRADOC Cost and Operational Effectiveness Analysis (COEA) program, Chief of Staff, Army- and Office of the Secretary of Defense-level review councils, and CSA-level testing. (Other control mechanisms are Congressional and OMB reviews.)

Ultimately, the U.S. Army and Defense Systems Acquisition Review Councils (ASARC/DSARC) must recommend approval to proceed from one development phase to the next, e.g., from "validation" to full-scale development.

The make-up of the DSARC, in particular, is ample evidence of OSD's intent to conduct the reviews at the highest level. It is here that the customer and the developer, in the person of the PM, meet to assess the status of the weapon system and the major subsystems. For both the ASARC and the DSARC, the PM must be prepared to respond to a series of comprehensive checklists for each major milestone.

In the Soviet system, the customer and the developer, acting separately and jointly, exercise control over the development cycle. The customer monitors development from a quality control standpoint. Military officers are looking over the shoulders of design personnel to insure that requirements are being met, on schedule.

The developer, a specific design facility, maintains its own vigorous internal review of the program. In addition, as each milestone is achieved, a joint military-industrial state commission meets to review progress and approve going on to the next phase. Several commissions are meeting at any one time for different system development programs.

A commission is usually composed of representatives from the military main technical directorate and the design institution. Like the PM, the designer must present a thorough briefing containing documentation of his work. Thus, unless there are serious conflicts between the customer and the developer, the decision to proceed is made at a lower level than is the case in the U.S.

The success of the Soviet process depends on four things: 1) well-defined requirements which can be met by industry, 2) continuity of personnel and organizations, 3) strict military and industrial quality control procedures, and 4) cooperation between customers and developers within the state commission framework.

Built into the Soviet developmental process is a system of checks and balances which, paradoxically, seems to hasten the pace of R&D projects. As noted earlier, the Soviets have organizationally separated the customer from the developer and have defined their roles so that one is a check on the other.

While they function as "friendly adversaries," both put a premium on minimizing risk and getting new weapon systems into the inventory as quickly as possible. Thus, the Soviets use both built-in "strife" and cooperation to achieve R&D goals.

The U.S. also has a system of checks and balances. In the end, the ASARC and DSARC must be satisfied by the developer, AMC, before the process can continue. Both the requirements agencies and AMC work for the Army Chief of Staff.

In the U.S., the key to success lies in leadership's ability to maintain a rather delicate balance, whereby the functions and prerogatives of users, requirements generating agencies, developers, and review bodies are clearly defined and scrupulously controlled.

UNIQUE FEATURES OF SOVIET SYSTEM. The materiel acquisition processes of the United States and the USSR can be compared on several different levels, including structure, results, budgets, absorption of new technology, etc. Both processes are very complex and are shaped by many factors, not the least of which is design philosophy.

The tenets of the Soviet philosophy are simplicity of design, commonality of parts, and design inheritance from one generation to another.

In the space remaining, it might serve the reader to list those features of the Soviet process which are distinctively different and which are a commentary on how the Soviets rely on structure and organization to achieve goals.

- System customers are part of Ground Forces; system developers are not.
- Separate troop commands generate system requirements.
- Lower level requirements directorates/committees are headed by general officers.
- Schools/academies are subordinate to individual troop commands.
- Military technical academies train cadre of quality control officers.
- TTRs ultimately approved at Ministry of Defense level.
- The Ground Forces perform little systems R&D.
- Joint state commissions review development milestone achievement.
- Long-range, fixed plans keep development interruptions to a minimum.
- Continuity of personnel and military/industrial organizations assured.

4 DA Civilians Selected for Training Under FEDP

Four Department of the Army civilian employes are among 25 Federal Service executives recently selected for one year of intensive management training under the Federal Executive Development Program (FEDP).

Sponsored by the Office of Management and Budget and the U.S. Civil Service Commission, the FEDP provides rotational training assignments for executive branch personnel at the GS-15 or equivalent professional level.

Army selectee Donald S. Russ is chief, Reentry Physics Division, U.S. Army Ballistics Missile Defense Agency, Huntsville, AL. Employed at Huntsville for 10 years, he is responsible for management of ABMDA's reentry physics discrimination technology and reentry measurements programs.

James A. Kennedy is chief, Program and Budget Division, Office of the Comptroller, Department of the Army. During his 16 years of Army employment he has served numerous assignments in Europe and at installations in CONUS. In 1973 he was one of three civilians selected to attend the Industrial College of the Armed Forces.

Paul D. Mahoney, chief of the U.S. Army Civilian Appellate Review Agency, Office of the Army Deputy Chief of Staff for Personnel, has served in Army civilian personnel administration for 12 years. In 1967 he was selected for the Congressional Fellowship Program sponsored by the U.S. Civil Service Commission.

Pinkney M. Ryan is associate district manager, U.S. Army Audit Agency, and has worked in that agency for 14 years in various assignments in Europe, Vietnam and several CONUS facilities.

A New Dimension in Mine Warfare

By Allan R. Nunes-Vais

If we study U.S. Military Doctrine for use of mine warfare, we see the mine mission defined with words like "canalize," "disrupt," "delay," "deny" and "harass" the enemy. But words that imply "destroy" are rather prominent by their absence.

Interestingly enough though, if we look at the history of Mine Warfare, we find that mines, in particular antitank mines, have proven themselves as effective casualty producing weapons. If we go back to World War II and Korea, we find that 20 percent of our tank casualties resulted from mines. Under certain combat situations which enhanced their use, the rate increased up to 70 percent. More recently, in Vietnam, a disproportionate number of U.S. casualties resulted from mine warfare.

Generally speaking, U.S. Forces have not utilized mines to their greatest potential advantage, Why? Mines had very limited versatility, were time-consuming to emplace, and could only be used in defensive situations on land that you controlled.

That explains why adequate funding was not available for many years to pursue an aggressive development program to make available the types of mines needed to respond to the demands of modern warfare.

Our standard antitank mine in the stockpile today, the M15 Mine, is an example. It weighs 30 pounds with about 20 pounds of high explosive. It requires the manual insertion of the fuze, just prior to use. Until recently, when availability of a towed mine planter came into use, the M15 could only be emplaced laboriously by hand. Typically, this operation required 20 minutes per mine. With the mine fuzed to detonate under the vehicle track, it was necessary to emplace about one mine per meter to create an effective and believable barrier.

The M15 Mine can cause a rather significant logistic problem, not only in terms of moving the required tonnage from the supply point to the front, but also in terms of the time and personnel required to emplace a minefield. For instance, 10 men would each require about 6 hours of continuous labor, just to emplace a 160-meter field—and the mines would weigh almost 5,000 pounds.

Another disadvantage that exists when using standard mines, like the M15, is that once emplaced they can frequently pose as much of a threat to the mobility of our own troops as to the enemy. Time-consuming procedures are required to identify and clear the mined area.

To give mine warfare a new dimension, to make an order of magnitude improvement in our capability, a family of lightweight, effective and rapidly emplaced mines was required—mines which could be used in close proximity to our Forces and support our combat operations in areas not necessarily under our control.

These mines, it was decided, would have to be capable of delivery by various means, provide a high degree of reliability and be cost effective; to permit flexibility in their use, they should be self-destructive at a predetermined time after emplacement.

In response to these stringent requirements, R&D engineers at the U.S. Army Picatinny Arsenal in Dover, NJ, conceived an aerially emplaced, scatterable mine system. Although the broad concept was first visualized in the early 1960s, a requirement did not materialize until impetus was provided by the conflict in Southeast Asia.

Today, such a mine system is a reality. The 4-year program to develop this Aerial Mining System, the M56, was conducted under the direction of the project manager for Selected Ammunition, COL Kilbert E. Lockwood. The M56 Mine Dispensing Subsystem is now in production.

The XM56 Subsystem consists of an aircraft dispenser, aircraft controls, and the mines. The subsystem was designed to be carried aboard the UH-1H helicopter which has a payload of 160 mines, 80 in each of two dispensers. At the outset of the program, it was decided, for economy of development and production, to use an existing dispenser. The Air Force's SUU-13 System, which had been engineered for production by Picatinny Arsenal, appeared to fill the bill and was selected.

Fully loaded with mines, the SUU-13 weighs 660 pounds. During the original feasibility study, system configurations were considered that would use one, two or three mines per tube. Weighing of all factors, and in particular mine effectiveness, led to the selection of two mines per tube. Each mine weighs about six pounds and contains just over three pounds of explosive—as compared to the 30-pound M15 mine.

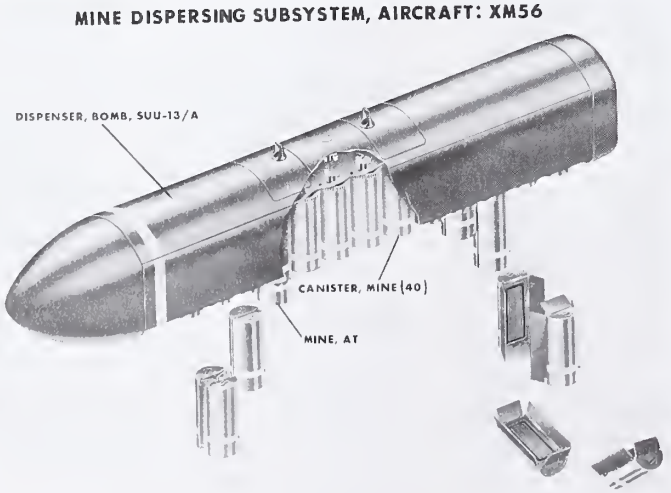
The dispenser ejects mines at a velocity of 15 feet per second by a small propellant cartridge electrically initiated. The aircrew can select a controlled interval between each canister or pair of canisters being dispensed. A choice between alternate or simultaneous firings of the two dispensers can also be made.

The selectable timing interval allows for changes of drop patterns at various air speeds. The number of mines to be dispensed can be selected and the controls also provide for electrical dispenser jettison if required. Published instructions in the operator's manual offer flexibility in selecting a pattern appropriate for various mission profiles.

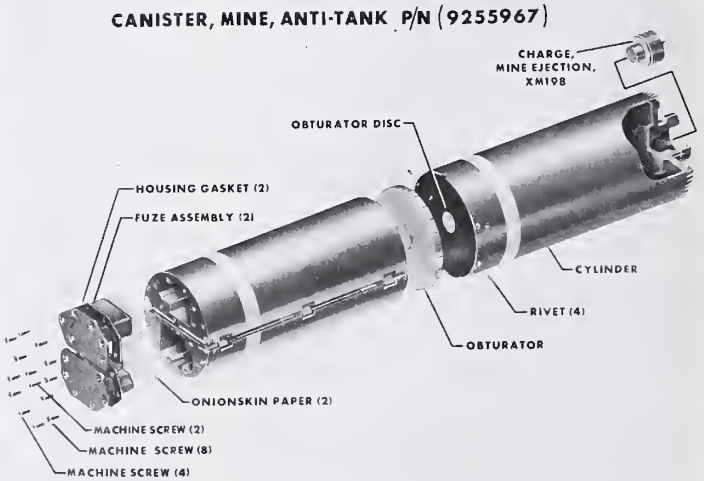
The mine has an extruded aluminum body in the shape of a half cylinder, about 10″ long by 4½″ diameter. Four spring-loaded fins are attached to the body and the fuze cavity is at one end. Added as the development progressed, the fins open as soon as the mines leave the tube, increasing drag and thus decreasing velocity and minimizing mine damage at impact. They also orient the mine in flight so that it always strikes the ground round side down—allowing one of the arming functions to take place.

The Safety and Arming device has a dual safety feature, actuated at ejection by re-

MINE DISPERSING SUBSYSTEM, AIRCRAFT: XM56



CANISTER, MINE, ANTI-TANK P/N (9255967)



lease of a bore-riding pin, with secondary input coming from ground impact. Final electrical arming is delayed, to allow the mine to bounce around after impact and come to rest. However, the mine will function properly regardless of final orientation on the ground.

The electromechanical fuze intelligence is provided by a small CMOS chip—the first application on one of these in an Army Mine System. A simple electroplating device provides the self-destruction timing function.

The electronics control the arming delay, provide discrimination for proper fuzing between wheeled and tracked vehicles, and have a countermeasure resistance capability. Power to run this circuitry is provided by a small mercury cell inserted at the supply point just prior to use.

Although the Air Force developed the SUU-13 Dispenser for one-time use aboard high-performance aircraft, Picatinny Arsenal engineers found that considerable savings would accrue if the dispenser hardback could be reused.

As a result of testing, the M56 will be shipped to the field in the form of one fully loaded dispenser, with four reload kits supporting each dispenser. Each kit will contain 40 loaded tubes (2 mines/tube) and an installed ejection cartridge. After initial use, the expended tubes are removed from the dispenser, which is then reloaded. The cost of one dispenser is thus amortized over five uses.

Although this program was handled basically at Picatinny Arsenal, where the design and systems integration was done, it is considered as a good example of government-industry cooperation.

ALLAN R. NUNES-VAIS, chief of the Mine Branch, Ammunition, Development Engineering Directorate, has been employed at Picatinny Arsenal, Dover, NJ, for more than 20 years. He is a recipient of the Decoration for Exceptional Civilian Service, the Army's highest award for civilian employes. Noted for his contributions to munitions developments, he has a BS degree in electrical engineering from Manhattan College and served in the U.S. Navy during World War II.

The Test and Evaluation Command measured technical performance against requirements and also considered the military worth of the M56 system. In this later phase, troop tests as well as war game exercises were conducted to compare typical combat situations both with and without this mine system.

The TECOM evaluation phase was conducted over a one-year period. More than 1,000 mines were tested at Yuma Proving Ground, AZ, Fort Knox, KY, and Aberdeen Proving Ground, MD, as well as at the Arctic and Tropic test centers. The major conclusions drawn from this evaluation were that the M56 mine system met the requirements to which it was designed and that it would significantly increase the U.S. capability to wage mine warfare.

A minefield marking system, compatible with the M56 control system, is being developed at the Mobility Equipment Research and Development Center, Fort Belvoir, VA. If desired, this system can be used in conjunction with the M56 to mark the minefield from the air.

The M56, as a mine system, is radically different than anything we have known in the past. Other scatterable mine systems which will complement this one are in earlier stages of development—also under the direction of the Army Materiel Command Project Manager for Selected Ammunition.

When all these systems become available, a totally new dimension in mine warfare will have been added to our combat capability. Our new M56 Aerially Dispensed System will have paved the way from a static to a dynamic type of mine warfare.

LWL Disestablished June 30 . . .
Ends 12 Years of Rapid Response Mission

D-Day for the U.S. Army Land Warfare Laboratory came June 30 when it was disestablished as part of Army-wide reorganizational changes linked to cutbacks in funding and manpower resources.

Staffed with 94 civilians and 18 military personnel when it was abolished, the LWL was established in June 1962 as the Limited War Laboratory—with a mission of rapid response to urgent military requirements in remote areas.

Redesignated in 1970, the LWL was transferred in February 1973 from the Office of the Chief of Research and Development, HQ Department of the Army, to the Army Materiel Command. Part of the LWL mission will be continued at the U.S. Army Human Engineering Laboratory and at Edgewood Arsenal, both at Aberdeen Proving Ground.

Some of the civilian spinoff benefits of the LWL were demonstrated and described in briefings during its final week of existence. Representatives of a number of U.S. Government agencies came to look at many of the items of civil disturbance (riot control) equipment developed, by application of LWL advanced technology, in response to law enforcement agency requests.

Part of this effort originated to meet requirements of the Military Police Corps and the National Guard. Equipment demonstrated to the LWL's final large group of civilian agency visitors included an airborne public address system for crowd control, an airborne TV system to provide continuous information on the situation, and a radar intrusion detector.

Additional items were a kit to convert a jeep into a riot control vehicle, riot control barriers, a rope that can be positioned for best effect and then ignited to provide an instantaneous smoke cloud, two versions of a portable pumping system (often termed a water cannon), and various types of less-than-lethal weapons and munitions to control an unruly crowd without causing lasting injuries.

More than 300 items are listed as LWL R&D products. Among these are a 2-pound floatation unit to support a soldier and 60 pounds of gear in water; a 65-pound portable sound system with a range of 1,000 yards; a 2-man tent, light, easy to carry, roomy and erectable by one man in two minutes; a water quality test kit weighing only five pounds to check out the chemical quality of raw or treated water for consumption in the field; and a hand-held radar detector to provide soldiers with early warning when enemy forces are using ground radar for battlefield surveillance.

Other items include a back-pack navigation computer that enables a soldier to determine where he is at all times; a chemical process human waste disposal unit; a field water purifier that converts brackish water into pure drinkable water for troops in the field; an airborne smoke generator to protect troops landed in jungle clearings by helicopter; a jungle canopy platform to provide a landing capable for helicopters in dense jungle areas; and a compact, lighweight individual aid survival kit for use in various environments.

WSMR Recognized for Cost Savings on RTCDS

Considerable pride is being evidenced at White Sands (NM) Missile Range over what is regarded as an outstanding accomplishment in estimating—despite inflation in materials and labor costs during nearly three years—the cost of an operational RTCDS.

That acronym denotes Real-Time Cinetheodolite Data System, used for vectoring helicopter flights at Yuma Proving Ground in Arizona. The contract cost was estimated at $962,119 and the actual cost was $980,841—including $24,217 for additions not specified in the basic design contract. Omitting that unplanned expense, the delivery price of $956,624 would fall $5,495 below the original estimated contract cost.

Since August 1972, personnel of the WSMR Instrumentation Directorate have provided technical assistance to the contractor during development of the RTCDS. They also have designed and assisted in preparation of facilities at Yuma PG for the installation and acceptance phase of the contract.

WSMR personnel responded originally to a request from the Army Test and Evaluation Command to perform an analysis and design of a real-time cinetheodolite space positioning system. TECOM is an element of the Army Materiel Command.

The contractor, Gorez/Inland Systems Division, successfully demonstrated the fully operational RTCDS during March 1974 to a dynamic tracking accuracy of one meter. The RTCDS consists of three cinetheodolites which provide digitized angle data, over high-quality communication links to a central computer for real-time space position determinations. A semiautomatic film reader processes the data, with boresight correction, for post-flight data analysis.

In recognition of their contributions to the developmental effort, Kenneth Bellinger, task manager, received a quality step increase in salary and Patrick S. Quinlan and Burton L. Williams received Special Act or Service Awards.

SPEAKING ON . . .

(Continued from inside front cover)

CDDP, dated Nov. 21, 1973.

Other Canadian Government departments and agencies participating in the Defense Development Sharing Program include the Canadian Commercial Corp. (CCC), owned and controlled by the Canadian Government.

The project agreement is implemented through a contract(s) negotiated between the designated U.S. development agency and CCC and, in turn, through CCC entering into contractual arrangements for R&D by selected developmental organizations.

These organizations include the Canadian firms participating in the R&D and may also include Canadian Government agencies or U.S. firms or government agencies as part of the project effort.

Development sharing projects are those performed by Canadian prime contractors; meet DoD R&D requirements; those in which a U.S. military department acts as design authority; or those funded jointly by the U.S. and Canada.

International Professional (Scientist & Engineer) Exchange Program. At a meeting between the U.S. Secretary of Defense and the German Minister of Defense, Dec. 4, 1963, agreement was reached that the U.S. "provide practical experience in military research, development, production, and testing activities to professional, technical and scientific personnel of the Federal Ministry of Defense."

The Secretaries of the Army, Navy and Air Force were notified by a Director of Defense Research and Engineering Memo dated Feb. 23, 1964, "Training of German Ministry of Defense Scientific and Engineering Personnel." This program was extended on Aug. 26, 1965, to include Japan.

Procedures of this program have been applied to five on-the-job assignments of Australians. Three Koreans were assigned in January 1974, and six more are to be assigned in July 1974 under the auspices of Data Exchange Agreements (DEA).

Although no U.S. Army regulation or formal DoD directive applies, AMCR 70-21 consolidates Army guidance and prescribes responsibilities and procedures. The program is implemented through on-the-job RDT&E assignments of foreign professionals within U.S. Defense and contractor facilities.

AMCR 70-21 also implements DoD-approved bilateral arrangements with the German Ministry of Defense and the Japanese Defense Agency. It also applies to subsequent and similar international arrangements, such as Data Exchange Agreements with other nations approved by DoD.

Foreign engineers in this program remain employed by their country while undergoing training in the U.S. for one year. All their expenses in connection with the program are paid by their country, and they are under administrative supervision of the scientific attache in Washington, DC.

Neither the U.S. Army nor the training installation assumes any responsibility or obligation for housing or other individual requirements other than those accorded to U.S. Civil Service or contract employes.

Advisory Group on Aerospace R&D (AGARD). Established as a NATO agency under the authority of the military committee, AGARD is composed of panels of experts in science and technology relating to aerospace. Among these fields are Electromagnetic Wave Propagation; Avionics; Flight Mechanics; Fluid Dynamics; Guidance and Control; Propulsion and Energetics; Structures and Materials; and Technical Information.

AGARD panels exist to bring together representatives of NATO nations in science and technology relating to aerospace. They recommend use of NATO R&D capabilities, provide scientific and technical assistance to the military committees, and stimulate technical advances through international cooperation and data exchange.

Twenty-six AMC personnel attended AGARD meetings and symposia during Calendar Year 1973 as members or by invitation to present technical papers.

NATO—Army Armament Groups. The NATO Conference of National Armament Directors (CNAD) replaced the Armaments Committee in 1966. Acting under authority of the Council on Defense Equipment and Related Problems, the CNAD is composed of senior governmental representatives responsible for defense equipment.

To provide a point of contact, each NATO country has a member of its permanent delegation serve as the representative of its National Armaments director. CNAD also has established working groups responsible for promoting cooperation in developing and producing equipment and related logistics aspects. They handle operational requirements, initiate cooperative projects, and establish specific working panels to assist in accomplishing their functions.

The AC/225 Army Armaments Group, for example, functions to:

- Exchange information on R&D related to weapons systems and equipment for land forces, national concepts, and doctrine of land warfare.
- Identify suitable areas or individual proposals for bilateral or multilateral cooperation.
- Cooperate and maintain close liaison with Air and Navy Armaments Groups.

AMC participates in and provides representatives to serve as members on 13 panels ranging from combat vehicles, infantry weapons, land-based air defense, combat intelligence and NBC defense to automated data processing. Sixty-four AMC personnel attended AC/225 meetings during CY 1973.

NATO—Defense Research Group. CNAD has established working groups responsible for promoting cooperation in developing and producing equipment and related logistics. Chartered to handle operational requirements and initiate cooperative projects, they establish specific working panels to assist them in accomplishing their functions.

One of these groups, AC/243, participates in long-term scientific studies; long-term defense against NBC warfare; physics and electronics; current and long-term far-infrared (IFF). Panel VII is an Exploratory Panel on Defense Applications of Operations Research.

AC/243 functions include exchange information on new research and technology that might lead to future equipment; review possible military consequences of advances in the field of science and technology; identify suitable areas or individual proposal for bilateral or multilateral cooperation in defense research; undertake studies, at the request of any of the three Service Armament Groups, in fields where requirements cannot be met until a breakthrough or a serious advance in technology has been achieved; cooperate and maintain close liaison with the Service Armament Groups.

Thirty-five AMC personnel attended international meetings of panels in CY 1973.

NATO Group of Experts on Electronic Parts. The AC/67 group of experts on electronic parts was established by the CNAD. Its function is to insure availability of adequate quantities of assured-quality parts for electronic equipment of NATO nations, and to foster economy in development and production of the parts.

The AC/67 group facilitates operations of NATO forces by encouraging use of the minimum number of selected types of electronic equipment having the maximum practical degree of interchangeability of parts, and by defining the possibilities.

Specific areas of mission responsibility have been assigned to 8 working groups.

- To exchange technical information on R&D of electronic parts and to report on areas in which development appears to be lacking or unnecessarily duplicated.
- To propose special tests and NATO recommendations that will be mutually acceptable, and general test methods being covered by the group of experts on electronic parts.
- Within the framework laid down by the group of experts on electronic parts, to propose a uniform system of markings for Standardization Agreements (STANAGs).
- To propose preliminary draft standards, specifications and NATO Electronic Parts Recommendations (NEPRs)—particularly for new construction.
- To take account of any other international activity within their field, in particular to follow relevant recommendations wherever military needs are not prejudiced thereby.
- To exchange information on production, inspection and related matters.
- In special cases, as necessary or as directed by the group of experts on electronic parts, to exchange information on production plans to meet particular needs.
- To carry out other studies as necessary or directed by the group of experts on electronic parts.

AMC's participation in AC/67 encompasses providing 15 personnel in 1973 to serve as U.S. principal members or technical advisors to principal members, and providing the chairman of the group of experts.

Military Agency for Standardization (MAS). Established in 1951, MAS consists of a chairman, terminology coordinator, coordinating committee, three service boards (Army, Navy and Air Force), and an international secretariat.

As the principal NATO agency dealing with standardization, the MAS functions to

initiate standardization proposals in conformity with the military committee standardization policy; to assess proposals for standardization, arising primarily from military considerations; and to refer proposals outside its purview to the military committee; to refer standardization proposals, as appropriate, to working parties or to a country prepared to accept custodianship of the proposals; to promulgate NATO STANAGs and maintain a registry.

To sponsor and promulgate allied publications and reports for which it is responsible and to maintain a central registry of such publications; to arrange for the exchange of equipment; to recommend and arrange for comparative trials of equipment; to coordinate demonstrations of equipment; and

To invite NATO countries to subscribe to standardization agreements resulting from regional agreements filed with the MAS by other regional groups; and to maintain liaison with NATO commands, the Defense Support Division of the International staff, and appropriate North Atlantic Council agencies.

AMC's participation in MAS activities consists of providing U.S. principal members and technical advisors to the various working parties and panels (25 to 15 in 1973).

American, British, Canadian, Australian (ABCA) Armies Standardization Program. The ABCA Program was formalized in the "Basic Standardization Agreement" signed by the four subscribing armies in 1964. New Zealand, not a signatory, is associated with the program through Australia. ABCA functions include:

- Ensuring the fullest cooperation and collaboration among the subscribing armies.
- Achieving the highest possible degree of operational compatibility through materiel and nonmateriel standardization.
- Obtaining the greatest possible economy by use of combined resources and effort.

The key to achieving standardization under the Agreement is the free and timely exchange of information on matters of interest to the four armies. This is achieved through the circulation of appropriate conceptual papers, studies and national development documents for information and comment, and during discussions among 21 Quadripartite Working Groups (QWGs).

AMC has participated in 15 QWG meetings in 1973, by furnishing the principal member for 10 meetings and technical representatives for five. (For further information on the background, organization and mission of the ABCA Standardization Program, see March-April 1972 *Army R&D Newsmagazine.*

The Technical Cooperation Program (TTCP). The TTCP was born of subordinate conferences held during discussions by the President of the United States and the United Kingdom Prime Minister in 1957.

The resulting agreement called for establishment of technical subgroups under a nonatomic military R&D (NAMARAD) subcommittee. The TCP began operations in 1958 with the U.S., the U.K. and Canada as members. Australia and New Zealand entered later.

The NAMARAD subcommittee is comprised of "principals." The U.S. principal is the Director of Defense Research and Engineering. The chief scientific adviser to the Ministry of Defence is the U.K. principal. Chief Defence scientists are the principals from Australia and New Zealand. The chairman of the Defense Research Board is the Canadian principal.

NAMARAD principals have delegated to a group called the Washington Deputies the responsibilities for overseeing and managing the program—that is, the activities of the subgroups and their technical panels. The U.S. Washington deputy is the deputy director (Research and Advanced Technology) in the Office of the Director of Defense Research and Engineering (ODDR&E).

The other deputies are Embassy-based defense officials in Washington. The Australian deputy also represents the interests of New Zealand. A Washington Secretariat (one member from each country, with Australia representing New Zealand) assists the Washington Deputies.

From its inception until 1971, TTCP grew from the original 8 to 17 subgroups involving 57 panels and 43 working groups. The panels were comprised of technical experts representing specialty fields encompassed by the terms of reference of the subgroups. The working groups were subdivisions of panels, deriving their membership from and performing specific tasks for the panels.

The current structure of TTCP is designed into 7 subgroups comprised of technical panels and action groups. The subgroups are: Subgroup E—Chemical Defense, H—Aeronautics Technology, J—IR and EO Sensor Technology, K—Radar Technology, P—Materials Technology, Q—Electronic Warfare, S—Communications Technology, U—Behavioral Sciences, and W—Conventional Weapons Technology.

AMC participates in designating members for new subgroups and confirming old members or designating new members.

Air Standardization Coordinating Committee (ASCC). Formed in 1965, the ASCC consists of a committee of members of general equivalent rank from each of the five countries involved (U.S. Air Force, U.K. Air Force and Ministry of Aviation, Canadian Air Force, Australian Air Force, New Zealand Air Force).

The function of the ASCC is the negotiation of agreements between the respective Air Forces, covering a wide field of operational and technical subjects, which are implemented nationally. Agreements are developed as ASCC air standards by the different working parties, consisting of members from each Air Force. These 22 working parties are technical subcommittees of the ASCC.

In addition to the exchange of technical information, documents and agreements, the program allows the loan of equipment. Member nations have signed a "Master Agreement for the Exchange of Equipment for Test Purposes," which permits the free loan of equipment between member nations for evaluation.

The AMC in 1973 furnished 16 technical personnel to the 10 working parties in which it has membership. Through these working party conferences, the ASCC seeks to avoid duplication of standardization effort and pursue a policy of assisting other standardization agencies (civilian and military).

AAMCA Team Gets Together for Final Meeting

Members of the management team of the U.S. Army's Advanced Materiel Concepts Agency pose for a final meeting before the June 30 dissolution of their agency. Organized in March 1968 as part of the Advanced Concepts Organization (ACO), the agency contributed the advanced materiel concepts for the Land Combat System Study-I (1990), which was the responsibility of the Institute of Land Combat (CDC).

The study was designed to utilize the materiel for the tactics and doctrine devised to meet the threat of future warfare as extrapolated by the intelligence community, represented in the ACO by the Intelligence Threat Analysis Detachment, an agency of the Army Assistant Chief of Staff, Intelligence. Elements of the ACO are being disbanded as the study has been completed.

Left to right: 1st row (seated) COL William E. Zook, deputy director and commanding officer; George K. Hess Jr., director; J. H. Berardelli, management support officer; (standing) Jeff W. Boucher, chief, Combat Service Support Division, Systems Applications Directorate (SAD); COL R. E. Ready, chief, Army Space Program Office (AMC); Emil M. Szten, chief, Mobility Division, SAD; Frank Milner, chief, Science and Technology Directorate (STD); Theodore S. Trybul, chief, Effectiveness Analysis Division, Preliminary Systems Engineering Design Directorate (PSEDD); A. C. Elser, chief, PSEDD; Robert J. Fallon, chief, Applied Sciences Division, STD; John Gensior, chief, SAD; and Halvor T. Darracott, chief, Technological Forecasting Division, STD.

TACOM RADOC

ADVANCED PLANNING BRIEFING FOR INDUSTRY

U.S. Army requirements for combat vehicles, tactical vehicles and other materiel developed in support of user activities were reported and discussed during an Advanced Planning Briefing for Industry (APBI), May 29, at the U.S. Army Tank-Automotive Command (TACOM), Warren, MI.

Nearly 350 Department of Defense officials and industrial representatives assembled in the TACOM auditorium for the first APBI briefing sponsored jointly by developer and user representatives—TACOM, and the Army Training and Doctrine Command (TRADOC), headquartered at Fort Monroe, VA.

APBIs are held to furnish to nongovernment personnel current, definitive information on mid- and long-range plans, policies and programs to obtain a maximum exchange of mutually profitable exchange with industrial organizations.

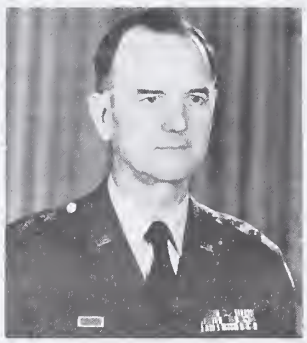
GEN Henry A. Miley Jr., Army Materiel Command (AMC) commander, and MG Stewart C. Meyer, AMC director for Research, Development and Engineering, were among the many top government and industry leaders who attended the classified briefing.

MG Joseph E. Pieklik, TACOM commander, welcomed the group and introduced GEN William E. DePuy, TRADOC commander, who gave the keynote address. MG Pieklik was introduced by COL Ronald E. Phillip, director of RD&E at TACOM, who later discussed "Tank-Automotive Thrusts and Programs."

GEN DePuy emphasized the need for TRADOC and AMC to develop jointly the requirements of the volunteer Army, with TRADOC ensuring that the real combat need is stated and AMC ensuring that the requirement is within the current technology.

In reviewing the lessons learned from the Mideast war, he noted that the tank losses during the 20-day war were staggering on both sides. American and Russian tanks were about equally matched, he stated. However, the tactical ability of Israeli crews proved superior.

AMC Commander GEN Henry A. Miley Jr. and industrial representatives view transmission model, one of many displays at recent APBI held at TACOM, Warren, MI.



MG Joseph E. Pieklik
TACOM Commander

As the first commander of TRADOC, which became fully operational as a major command July 1, 1973, GEN DePuy discussed the training and equipment needs of the individual soldier in today's Army.

TRADOC is not the user of Army materiel, he said. The command represents the user only from the standpoint that it trains operators, maintenance personnel, and develops tactics.

GEN DePuy provided an overview of major activities of TRADOC, which include 23 Army service schools, seven Army training centers, four ROTC regional headquarters, the Combat Developments Experimentation Command, and three functional centers—Combined Arms Center, Fort Leavenworth, KS; Logistics Center, Fort Lee, VA; and the Administrative Center, Fort Benjamin Harrison, IN.

"Decentralization is the word," he said. "Development should be coordinated between the AMC Commodity Command or Project Manager and the appropriate TRADOC Combat Center—not between AMC and TRADOC headquarters. Decentralization and teamwork at the working levels are what is desired.

"Cost restraints are real, and we cannot afford costly systems. If industry can improve our systems, or develop new systems that represent a substantial improvement in total effectiveness and are also cost-effective, TRADOC and AMC will buy the systems. If they don't meet these criteria, forget it."

"User Requirements—Combat Vehicles," was discussed by MAJ Douglas Smith and MAJ Ted Danielson, project officers with the Combined Arms Center. MAJ William A. Call Jr., project officer with the TRADOC Concept and Studies Division, followed with "User Requirements—Tactical Vehicles."

Paul D. Denn, chief, Systems Division, TACOM, in discussing "Advanced Vehicle Systems," described R&D program planning beyond 1990, factors that shape future combat vehicles, and guidelines for improving systems survivability and for reducing weight and cost.

"Armor Materials and Components for Tomorrow's Army" was presented by Robert J. Otto, chief of the Armor Materials and Components Division, TACOM.

Lowell H. Barnett, chief of the Propulsion Systems Division, TACOM, discussed "Propulsion Systems Compatible With Energy Sources."

Following the presentations, COL Phillip presided over a panel discussion, which included answering of questions submitted by representatives on how industry can most effectively apply its resources in developing the combat and tactical vehicles, and associated equipment to support national defense.

John J. Lanyon, TACOM, was project officer for the APBI.

ARMY & INDUSTRY representatives view mini-cooled turbo-compound diesel engine exhibit during recent APBI.

TRADOC Commander GEN William E. DePuy (left) and COL Ronald E. Phillip, director of TACOM RD&E, hold informal discussions with industry representatives.

Conferences & Symposia . . .

AMC RD&E Director Speaks as Keynoter . . .
Camouflage Program Conference Held at MERDC

Speaking as the keynoter for the Army Materiel Command Camouflage Program Conference at the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, VA, June 4-6, MG Stewart C. Meyer, AMC Research, Development and Engineering director, addressed more than 200 participants.

General Meyer called the 3-day gathering the first concentrated effort to provide an in-depth briefing for a large number of personnel working on the camouflage program within AMC elements, the Forces Command (FORSCOM), Training and Doctrine Command (TRADOC), and Troop Support Command (TROSCOM).

In explaining the urgency of the camouflage program, the existing technology, and the use of camouflage to enhance combat survivability, he said it has become "one of the AMC major thrust efforts, with increased command visibility. It will be incorporated on an AMC-wide basis into selected R&D programs and into the retrofit or modification of deployed items."

Concluding his address, General Meyer cautioned against thinking that rear echelon equipment may not require camouflage, saying:

"One of the brutal messages of this conference may be the new dimensions of the zone of accurate hostile surveillance and the long range of accurate hostile weapon systems. In order for a materiel item to demonstrate its high performance, it must survive. Camouflage offers an important step toward enhancing battlefield survivability."

COL T. R. Hukkala, MERDC commander, welcomed the conferees, stressing the MERDC role as the AMC "lead" laboratory for the Army camouflage RDT&E program.

Discussion included trends in night vision equipment, environmental effects on target contrast, aided and unaided visual detection and recognition performance, aerial detection of tactical camouflage, radar technology trends, radar, ground-to-ground, tactical sensors, and the Soviet surveillance threat.

Presentations were made by the U.S. Army Night Vision Laboratories, U.S. Army Imagery Interpretation Center, U.S. Air Force Avionics Laboratory, the Electronics Command Combat Surveillance and Target Acquisition Laboratory, MERDC, and the U.S. Army Foreign Science and Technology Center. A night demonstration showed night vision devices, radars and imagery analysis in operation.

MERDC Acting Technical Director T. G. Kirkland led off the second day session with a briefing of the MERDC organization to support camouflage. He was followed by Henry R. Atkinson, chief of MERDC's Countersurveillance and Topographic Division, who gave a camouflage overview.

AMC RD&E DIRECTOR MG Stewart C. Meyer views camouflage paint patterns displayed at Camouflage Program Conference. With him is COL T. R. Hukkala, commander of the MERDC.

Other MERDC presentations and demonstrations included paints and coatings, disruptive pattern painting of vehicles, and camouflage screening systems. Speakers from the Natick Laboratories, MERDC's associate R&D agency in TROSCOM, reviewed camouflage of the individual soldier and his equipment. The Tank-Automotive Command contributed presentations on built-in vehicle camouflage.

Frank B. Paca, chief of the MERDC Camouflage Effectiveness Assessment Office, discussed camouflage techniques that can be incorporated into the design and use of military systems. Presentations were made by personnel of the Combat Development Experimentation Center and the Modern Army Selected Systems Test Evaluation and Review (MASSTER). T. G. Kirkland was the luncheon speaker on "The Integration of Camouflage into the Army." A panel discussion concluded the conference.

13th Operations Research Symposium . . .
Top DoD, Army Leaders to Join 250 Attendees

MG Hallgren

MG Van Lydegraf

MG Graham

More than 250 Army, academic and industrial leaders are expected to consider "The Value of Operations Research to the U.S. Army," the theme for the 13th Army Operations Research Symposium.

Scheduled Oct. 22-25 at the U.S. Army Logistics Management Center, Fort Lee, VA, the unclassified symposium will be sponsored for the first time by the U.S. Army Concepts Analysis Agency, commanded by MG Hal E. Hallgren.

John T. Newman, deputy commander and technical director of the U.S. Army Concepts Analysis Agency, will serve as the chairman of the symposium, which was sponsored last year by the Assistant Chief of Staff for Force Development, and for the first 11 years by the Chief of Research and Development, Department of the Army.

This year the U.S. Army Logistics Center, commanded by MG Erwin M. Graham Jr. and the U.S. Army Quartermaster Center and Fort Lee, commanded by MG Dean Van Lydegraf, will serve as cohosts. All of the previous OR symposia were hosted by the Army Research Office, Durham, NC.

Attendance, as in the past, will be limited to invited speakers and participants. A cross section of the ORSA community that is both analyst- and user-oriented is expected to attend general and special working groups which will address solicited and contributed papers consistent with the theme.

Guidance to all major commands concerned and authors of technical papers programed for presentation indicated that six working groups have been tentatively selected in an attempt to better assess the value of ORSA techniques in supporting the Army's requirements.

Five working groups will consider the value of ORSA contributions to the Army Force Structure; Materiel Acquisition; Logistics Matters; Weapons Effectiveness Analysis; and to Operations, Plans, Doctrines and Concepts. A sixth working group will focus on the technical methods of assessing the value of ORSA.

Selected high-quality technical abstracts and papers presented during AORS XIII will be included in the published proceedings.

Inquiries pertaining to the symposium should be submitted to: Commander, U.S. Army Concepts Analysis Agency, ATTN: MOCA-JFL/ MAJ Biegel, Bethesda, MD 20014.

AMC Researchers Brief ASA (R&D), GS On Important Technological Advances

Technological advances considered by U.S. Army Materiel Command evaluators as sufficiently significant to warrant recent briefings to the Assistant Secretary of the Army (R&D) and other General Staff R&D executives have included:

- "Microsecond Electronic Tuning of High Power Circuits at VHF and UHF," presented by George C. Fincke of the Beam, Plasma and Display Technical Area, Electronics Technology and Devices Laboratory, HQ Electronics Command.
- "Relative Behavior of Horizontal and Vertical Polarization in a Microwave Landing System," CPT Paul S. Demko, R&D technical operations officer, Avionics Laboratory, HQ Electronics Command.
- "In-house Laboratory and Remote Raman Program," Harry P. DeLong, Development and Engineering Directorate, Edgewood Arsenal, Aberdeen (MD) Proving Ground.

Fincke has been in U.S. Government service for 32½ years and has distinguished himself by his research with the Electronics Command.

CPT Demko is representative of the new generation of military scientists and engineers. He has been an Army employe since he received his bachelor of mechanical engineering degree in 1967 from Youngstown University; he has received the Bronze Star and 12 Air Medals.

DeLong is a candidate for a doctorate in environmental engineering at Johns Hopkins and has been in government service 28 years.

Abstracts of their presentations follow:

"Microsecond Electronic Tuning of High-Power Circuits at VHF and UHF." *Background:* Electronic warfare transmitters are required to operate over a broad frequency spectrum to counter multiple emanations from enemy equipment. The time required to mechanically tune the transmitter is too long for this method to be used in modern equipment. Wide instantaneous bandwidth tube type jammers have been used; however, this type amplifier suffers from low DC/RF conversion efficiency resulting in large power supply weight. In addition, this type amplifier has poor rejection of spurious, harmonic and intermodulation products. More recently multiple transistorized power module amplifiers have been developed for one kilowatt average output and 40 percent bandwidth at UHF. Although efficiency has been improved from 12 up to 25 percent in these transistor modules, the intermodulation distortion and harmonics still remain at the -20 to -30 dB level. The radiation of this level of harmonic and intermodulation distortion is unacceptable in such EW systems.

Summary Description: A new electronic switching technique has been developed for tuning high power tube circuits in less than one microsecond to any frequency in a wide frequency range (more than one octave at VHF and 40 percent at UHF) with an amplifier efficiency of 40 to 50 percent. This tuning technique utilizes switched multiple solid state PIN diodes distributed along the length of a helical or stripline circuit at VHF or in switching radial, inductive spokes in a coaxial cavity circuit at UHF. Intermodulation products are reduced by 100 to -40 to -50 dB. The PIN diodes may be switched in less than one microsecond, either singly or in combinations, to provide the proper inductive susceptance for the circuit. The power varies less than 1 dB.

Significance and Benefits to be Realized: The improved efficiency obtained with this technique will significantly reduce power supply weight and size in addition to improving equipment operation by reducing intermodulation products. For example: In a classified airborne VHF jammer system four rapidly tuned power tube amplifier modules were fed into a common antenna using hybrid power combiners. The rapidly tuned power tube systems demonstrated twice the efficiency and 17 dB lower intermodulation products than the broadband transistorized power modules. This improvement in efficiency results in a reduction in power supply weight and size of 300 pounds and 10 cubic feet respectively. In addition the cost of the power tube system is one-third that of the solid state system.

"Relative Behavior of Horizontal and Vertical Polarization in a Microwave Landing System." *Background:* For several years both the National Program for the development of the Microwave Landing System (MLS) and DoD efforts to establish an Interim Military Microwave Landing System (IMMLS) have specified that the polarization of the radiated signals in a microwave landing system should be vertical.

In June 1972, CPT Demko first reported results of his work to the FAA and its six contractor teams participating in the National Program for the development of the MLS. Neither the FAA nor the six contractors agreed with CPT Demko's conclusion that the polarization of MLS should be changed from vertical to horizontal. These results, however, formed the basis for the Army's establishing an official position that horizontal polarization is required for IMMLS.

George C. Fincke

CPT Paul S. Demko

Harry P. DeLong

To assist in resolving the polarization question primarily for the DoD Ku band (15.4 to 15.7 GHz) interim systems, CPT Demko proceeded to expand his earlier work. He developed new data collection techniques for observing the adverse effects of multipath in flight, and he undertook to examine reflections from the ground and from various vertical surfaces—using two basically different airborne receiver/processor types evolved through Army and Navy development programs.

In September 1973, CPT Demko presented these and all his findings to a group of five nationally recognized experts in the antenna and propagation field which had been assembled by the FAA and DoD to review and hopefully to resolve the polarization question. Upon study of these data, the experts recommended that horizontal or, as a compromise, circular polarization be adopted for Ku band microwave landing systems rather than vertical polarization. Further impact of this recommendation on the National Program for the Development of MLS is presently being considered by FAA, DoD and others, including technical experts in other countries.

Summary Description of Accomplishment: Basically, CPT Demko showed that either horizontal polarization or vertical polarization can provide adequate landing system performance in the presence of ground reflections because the angles of incidence are very small, and therefore ground reflected power (multipath) is not strongly dependent upon polarization. He also showed, however, that undesired reflections from essentially all vertical objects is strongly polarization dependent because, within the azimuth coverage of a landing system, reflections from vertical surfaces most often occur over a wide range of incidence angles. For this situation, horizontal polarization is vastly superior to vertical polarization for reducing adverse multipath effects.

Significance and Benefits to be Realized: CPT Demko established that selection of polarization of the radiated signals in a Microwave Landing System is a very important consideration and he demonstrated that horizontal polarization is the technically correct MLS choice. —despite the fact that vertical polarization had for several years been selected in DoD and DOT(FAA) landing system developments. As a result of CPT Demko's work, it will be possible for the Army to employ successfully a Tactical Landing System in a great many more landing sites than would otherwise have been possible.

"In-House Laboratory and Remote Raman Program." A unique program to apply Raman Spectroscopy to detection of chemical agents is underway at Edgewood Arsenal. Studies have been directed toward obtaining Raman Spectra and measuring Raman differential scattering cross sections of the nerve agents, their degradation products and simulants. Sample fluorescence has hindered efforts but purification techniques developed in the laboratory have helped reduce this problem. The Raman spectra of agents GA, GB, GD, GF, VX, VM, EA3317, and EA3148 have been obtained, and differential scattering calculated.

Analysis of the spectral data for chemical agents indicates the presence of a very intense spectral band at about 740 cm^{-1} shifted frequency, and differential scattering cross sections of about 10^{-29} cm^2/molecule/steradian. The 740 cm^{-1} band has been tentatively attributed to the P-O-C symmetric stretch vibration of the molecule.

Simulants have been selected for testing of a unique truck/trailer mounted Remote Raman Spectrometer which has been undergoing extensive field testing. The instrument, with a range of 2 kilometers, has been challenged with atmospheric gases, SO_2, kerosene, organophosphorous vapor simulant and aerosols of diisopropylmethylphosphonate and trioctylphosphate. The preliminary data indicate high sensitivity.

Concurrent with the Raman effort, a preliminary study is under way of the feasibility of using the Remote Raman System for remote detection of biological organisms, using laser stimulated fluorescence.

The goal of these two programs would be the development of a device capable of remotely monitoring the atmosphere, and possible terrain, for chemical and biological agents with enough range and sensitivity to allow adequate alert time for troops in the field. Additional applications demonstrated and potentially feasible are in air pollution monitoring, drug processing plant detection, and explosive vapor detection. Preliminary studies will be described.

NJSHS Program Offers Influences to Catalyze Science Careers

Exposure to educational influences that may help to catalyze careers of high school students who have displayed exceptional scientific potential, by emerging from about 7,000 participants in 36 regions, is a goal of the Army-industry-academia sponsored National Junior Science and Humanities Symposium.

The 12th NJSHS at the Massachusetts Institute of Technology, May 15–18, offered a program featured by noted guest speakers, visits to the Army Natick Laboratories and major industrial laboratories, a trek along the "Freedom Trail" of American history, a choice of visits to Boston's world-renowned museums, and a Boston Pops Concert conducted by Arthur Fiedler.

Thirty-six students, one out of six from each of the 36 regional symposia during the past year in the JSHS program sponsored by the United States Army Research Office, Durham, NC, presented research papers. A panel of senior scientists selected five to participate in the International Youth Science Fortnight, July 31 to Aug. 14, in London, England.

The winners and the titles of their papers are: Etta Lovitt, Harris County Sr. H.S., Hamilton, GA, "The Detection of Possible Free Amino Acid Abnormalities in the Blood Plasma of Leukemia Patients through the use of Gas Chromatography"; Michael J. Pelletier, New Haven (CT) Sr. H.S., "Analysis of Low Molecular Weight Aldehydes in the Cellulose Distillate"; and

Susan Yohn, Muscatine (IA) H.S., "The Effect of Splenic Injections on the Transplation of Skin in Mice"; Jordin Kare, Harriton H.S., Rosemont, PA, "Manipulation of Holographic Images by Reference Beam Variation"; and Francis G. Sydnor, St. John's H.S., Toledo, OH, "The Determination of the Optimum Conditions for the Isolation of Xanthi Tobacco Leaf Protoplasts and Their Use in Parasexual Interspecific Plant Hybridization."

Keynote speaker Prof Robert E. Ogilvie, Department of Metallurgy, Massachusetts Institute of Technology, discussed "Understanding the Origin of Meteorites Through Metallurgy."

Introduced by LTC Edward Downing, executive officer, Army Research Office, Prof. Ogilvie explained that meteorites, as the oldest material studied by man, offer a fascinating insight into the origins of the solar system.

Examinations of meteorites with the aid of the MIT one-million-volt electron microscope have established that, following Earth impact, they have cooled at the rate of about one degree per million years. From such observations scientists have fixed the beginning of the solar system at approximately 4.6 billion years in history.

DURING NATICK LABS visit, students attending 12th NJSHS are briefed by Dr. Edward Nebesky, director, General Equipment and Packaging Laboratory, on freeze-dried and irradiated foods.

WINNERS OF TRIP TO LONDON to attend International Youth Science Fortnight, July 31-Aug. 14, were selected for research papers presented at 12th National Junior Science and Humanities Symposium. With U.S. Army Research Office Commander COL Lovitt, Pike Pelletier. They were chosen by a panel of about 20 senior scientists.

Studies of meteorites and their role in the solar system date to about 1803 when the French Academy of Science agreed that they came from outer space. He showed the first block print of a single crystal meteorite, circa 1820.

Electron microscope and X-ray examinations of meteorites have shown that most of them have at least 10 percent nickel and some 50 percent or higher. His presentation covered the dendritic structure of meteorites and other fascinating aspects established by metallurgical studies.

Following Prof. Ogilvie's presentation, NJSHS participants were escorted by MIT students on tours of MIT laboratories, including the Strobe Lab, Computer Lab, Cognitive Information Processing Lab, Power Lab, National Magnet Lab, the Wave Tunnel and the Weather Radar and Meteorology Labs.

Army Research Office Commander Col Lothrop Mittenthal presided at the MIT afternoon session and introduced Dr. Everett S. Lee, professor of sociology at the University of Georgia, who spoke on "Growth and Redistribution of Population" in the United States.

Dr. Lee said the entire U.S. social system is founded on the migratory character of its citizens, and that the trend toward suburban developments is having a profound social, cultural and political impact on large cities, most of which are showing population declines. Farmers are forsaking the land for metropolitan life because about nine million of them are in a noncompetitive position with those practicing modern large-scale production.

One-third of the small towns in the United States also are losing population and 60 percent of the U.S. population is now in suburban areas of the larger cities, Prof. Lee stated. Much of the land area is going back into forests, he said, and New England states formerly largely covered by pine forests are now becoming hardwood forests.

While the Western World is reflecting a trend toward zero population growth, other parts of the world are showing explosive increases. China and India, he said, will double their populations in about 30 years at the current rates of increase.

Dr. Lee's address was followed by a lively student participation in discussion of what could be done to control population growth throughout the world, and to encourage genetic upgrading and "superior" people.

Dr. Lee is coauthor of *Population Redistribution and Economic Growth in the United States, 1870–1950,* and has authored numerous other publications.

Natick Laboratories Visit. NLABS COL Harry Corkill welcomed NJSHS participants when they visited there the afternoon of May 17, following individual selection of a choice of tours to laboratories of Ratheon Co.; Polaroid Co.; Bolt, Beranek and Newman; Arthur D. Little; Analog Devices Semiconductors; Megapulse, Inc., and Compugraphic.

COL Corkill presided at the session after the group was served a luncheon of combat rations freeze dried and thermo-processed, flexibly packaged foods developed by NLABS.

Dr. Mary Mandels, much in the news these days as a key member of the NLABS team that developed the technology for a process that has stimulated considerable interest in Congress, was the featured speaker at this session. Her topic was "Waste Cellulose as a Chemical and Energy Resource."

The group then broke into 10 discussion panels; "Taste Modification," as pertains to food; "New Technology in Food"; "Stress Physiology"; "New Developments in Food Packaging"; "Remote Sensing of Earth Features Using Satellites"; "Energy Alternatives"; "Overview of Oceanograph"; "The Metal With a Memory"; "Frontiers in Medical Science"; and "New Horizons in Engineering Technology."

Many of the NLABS most distinguished scientists, supported by top scientific leaders at MIT, the Army Cold Regions Research and Engineering Laboratories, the Army Materials and Mechanics Research Center, Woods Hole Oceanographic Institution, Walter Reed Army Medical Center, Edgewood (MD) Arsenal, the Army's Harry Diamond Laboratories and various major universities participated in the panels as speakers and discussions moderators.

Banquet Address. Judged by enthusiastic reaction of the students, one of the highlights of the 12th NJSHS was the banquet address by Dr. Harold E. Edgerton, MIT Professor Emeritus of the Electrical Engineering Department, who spoke on "Strobes and Sonar."

(Continued on page 31)

WORLD-RENOWNED Dr. Harold E. Edgerton, MIT Professor Emeritus and inventor of electronic strobe light, is surrounded on stage by students following banquet address at 12th NJSHS.

Awards . . .

25th International Science & Engineering Fair . . .

Outstanding Students Selected for Awards, Japan, Sweden Trips

Trips to Tokyo to participate in the 18th Japan Student Science Awards (JSSA) in 1975, and to Stockholm, Sweden, to attend 1975 Nobel Prize award ceremonies, were awarded by the military services at the recent 25th International Science and Engineering Fair (ISEF) at the University of Notre Dame.

Termed "Operation Cherry Blossom," the Japan trip was initiated in 1963 by the Army, Navy and Air Force, and continued by the tri-Services until 1972 and 1973 when the Army and General Motors Corp. (GMC) sponsored one winner each. This year, the Army and Navy selected one winner each to attend the 18th JSSA.

Jewel Anne Jurovich, 17, a senior at St. Mary's Dominican H.S. in Metairie, LA, was selected by 24 judges, including 11 Army Reserve officers affiliated with R&D activities, as the Army winner of the Japan trip. Her project was "Isolation and Characterization of an Antibacterial Agent From *Bacillus circulans.*"

Karen Lynn Wishmeyer, 16, a junior at Taft H.S., Chicago, IL, was selected as the Army alternate to the JSSA for her exhibit "Isolating a Biochemical Factor of Memory."

The Navy JSAA selectee is *Lawrence A. Wiedman,* 18, a senior at New Haven H.S., Fort Wayne, IN. He exhibited "Hydrodynamics and Littoral Current vs a Floating Barrier." *Lawrence H. Sverdrup,* 18-year-old senior from Libby H.S., MT, is the Navy alternate. His exhibit was titled "Design and Construction of a Pulsed Continuous Organic Dye Laser."

NOBEL PRIZE AWARD. In 1972, the tri-Services initiated the Nobel Prize Award as an ISEF honor. Each service sends one student.

Christopher S. Willson, 17, Merritt Island (FL) H.S. senior, will represent the Army at the ceremonies. His exhibit is "The Synthesis and ^{19}F Nuclear Magnetic Resonance Analysis of Fluorinated Oxetanes." *Dwight Collman,* 18, Roy (UT) H.S. senior, was selected as Army alternate for "Excluded Blood-Gas Interface During Erythrocyte Oxygenation."

OPERATION CHERRY BLOSSOM award winners, Jewel Anne Jurovich, the Army's representative for the Japan trip, and Lawrence A. Wiedman, Navy winner, flank Director of Army Research MG Charles D. Daniel Jr., during presentation.

Navy selectee *Denise Anne Miller,* 17, a junior from Cocoa H.S., Rockledge, FL, exhibited "Enhancement of the Activity of Cryogenically Treated Macrophages." *Natalie Jane Vandenberg,* 18, a senior from De Anza H.S., El Sobrante, CA, was selected as alternate. She exhibited "Host Recognition and Selection in *Dinocampus* coccinellae."

Air Force judges selected *Richard J. Foch,* 17, a junior from Astronaut H.S., Titusville, FL, for his exhibit "Kline-Fogleman Airfoil." Alternate *Alice Evelyn Koniges,* 16, a junior from Poway (CA) H.S., exhibited "Chromospheric Activity in Late-Type Spectroscopic Binary Stars."

Director of Army Research MG Charles D. Daniel Jr. presented the awards to the top Army winners who were among 11 Army Superior Award winners and 11 Meritorious Award winners. Gold medallions and expense-paid trips to an Army research facility were presented to Superior Award winners; silver medallions were presented to Meritorious winners. All 22 Army winners received Certificates of Outstanding Achievement signed by the Secretary of the Army and by the Director of Science Service.

The Army winners were selected from 380 finalists who participated in the 25th ISEF. Sponsored by Science Service, a nonprofit institution organized to popularize science, the ISEF is the culmination of competition among high school students who participated in over 200 affiliated local, state and regional fairs.

Finalists at the 25th ISEF represented 46 states, Canada, India, Japan, Philippines,

NOBEL PRIZE CEREMONY trip winner (Army) Christopher S. Willson receives congratulatory letter from the Secretary of the Army and a check from the Association of the U.S. Army (AUSA) from Director of Army Research MG Charles D. Daniel Jr. at the ISEF. The AUSA awards $100 to each of the Army winners selected to attend Operation Cherry Blossom or the Nobel Prize Ceremonies.

ARMY LABORATORY JUDGES. Seated (from left): John Barry, Deseret Test Center, Dugway (UT) Proving Ground; Dr. Gordon L. Bushey, Army Materiel Command HQ, Alexandria, VA; Dr. Idelle Peterson, Aviation Systems Command, St. Louis, MO; Dr. Durwood Rowley, Natick (MA) Laboratories. Standing: Dr. William T. Ebihara, Armament Command, Rock Island, IL; LTC David G. Reynolds, Walter Reed Army Institute of Research (WRAIR), Washington, DC; CPT Steve Hursh, WRAIR; Dr. Ralph E. Dusek, Army Research Institute, Arlington, VA; CPT William G. Kavanaugh, Edgewood (MD) Arsenal; Dr. Grant Gerhart, Tank-Automotive Command, Warren, MI; John W. Jarman, Office, Chief of Engineers, Washington, DC; Dr. Ellis L. Krinitzsky, Waterways Experiment Station, Vicksburg, MI; Dr. Sidney J. Magram, Army Research Office, Durham, NC; and LTC Aubrey F. Messing, Office, Chief of Research, Development and Acquisition, Washington, DC.

* * *

ARMY RESERVE OFFICERS JUDGES. Seated (from left): LTC Aubrey F. Messing, MAJ James V. Mengenhauser, CPT Ronald D. Stricklett, COL Edwin M. Vaughn. Second row: MAJ Gerald H. Elkan, CPT Edward S. Rosenbluh, MAJ John A. Replogle, MAJ John P. Jordan. Third row: LTC Robert E. Long, COL J. V. Perry Jr., MAJ S. M. McCarter, and LTC Harold Zallen.

Puerto Rico and Sweden. Exhibits of their research project categories encompassed the behavioral and social sciences, biochemistry, botany, chemistry, earth and space sciences, engineering, mathematics and computers, medicine and health, microbiology, physics and zoology.

ARMY SUPERIOR AWARD winners, in addition to the Operation Cherry Blossom and Nobel Prize Award ceremony choices are:

Jose M. Vega, 15, Immaculate Conception Academy, Mayaguez, PR, "Shape Discrimination in the Goldfish and Jack Dempsey"; *Ursula E. Schwebs,* 16, Washington-Lee H.S., Arlington, VA, "Electrical Characteristics of Plants"; *Gothard C. Grey,* 16, Olympus H.S., Salt Lake City, UT, "Solid-Fuel Rocket Technology"; and

Frank B. Jumonville Jr., 18, St. John H.S., Plaquemine, LA, "Rectifying Three Major Problems of the 4-Stroke Engine"; *Harry Galanty,* Henry Grady H.S., Atlanta, GA, "Programing Computer to Learn, Analyze and Play the L Game"; and

Barbara Jeanne Lounsbury, 17, All Saints Episcopal School, Vicksburg, MS, "Gravity Simulator and Other Devices for Experimental Analysis on Pendulums"; *Theresa Tomilo,* 16, Comstock Public H.S., Kalamazoo, MI, "Metastasis Through DNA Transition."

ARMY MERITORIOUS AWARD winners are *Edwin Roberto Lugo-Santiago,* 16, Lola Rodriquez de Tio H.S., San German, PR, "Biochemical Study of Sapogenins in *Agave sisalana* and Marine Organisms"; *Scott Rogers,* 18, Bonneville H.S., Ogden, UT, "Plant Taxonomy Through Lipid Paper Chromatographic Analysis"; and

David S. Bohle, 18, Greendale (WI) H.S., "Optical Activity of Complexes With Two Asymetric Centers"; *Alice Evelyn Koniges,* 16, Poway (CA) H.S., "Chromospheric Activity in Late-Type Spectroscopic Binary Stars"; *Patrick J. Spilman,* 18, St. Mary's Central H.S., Bismarck, ND, "An Answer to the Energy Crises?"; and

Ahang Rabbani, 18, Skyline H.S., Dallas, TX, "A Formula for the N^{th} Prime Number"; *Timothy J. Moore,* 17, Turtle Lake (ND) H.S., "Nicotinic Effects on the Developments of One Breed of *Gallus gallus*"; *Jon M. Huppenthal,* 16, Marquette H.S., Michigan City, IN, "Early Detection of Mammalian Cancer by NMR Spin-Spin Relaxation Times"; and

Therese M. Longtin, 17, North Augusta (SC) H.S., "Spread of Fecal Bacteria in Water"; *Douglas J. Patterson,* 17, East H.S., Memphis, TN, "Bioplasmic Aura of Life"; *David W. Hollas,* 18, C. H. Yoe H.S., Cameron, TX, "Boll Weevil Monitoring With Peromones."

Administrative arrangements for the ISEF were coordinated by Science Service Director Edward G. Sherburne Jr. and Mrs. Dorothy Schriver, assistant director. U.S. Army support to the ISEF, sponsored by the Chief of Research Development and Acquisition, was arranged by Mrs. Anne G. Taylor of the U.S. Army Research Office, Durham, NC.

Wolfe Memorial Trophy . . .
TOW Developing Team Wins Daedalian Award

Nominated by the Secretary of the Army for development of the TOW missile, a Tube-Launched, Optically-Tracked, Wire Command Link system, the developing team members recently received the Daedalian Weapon System Award and the Wolfe Memorial Trophy.

TOW is the first man-guided missile fired in combat by American soldiers. It proved its combat effectiveness against tanks in Vietnam in both helicopter and ground fired versions during 1972.

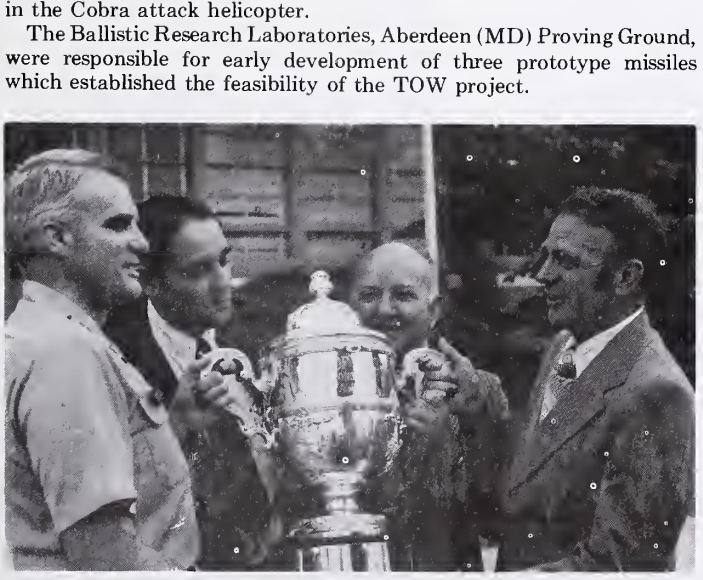
This prestigious award by the Order of Daedalians, a national association of military pilots, is presented to recognize outstanding achievement in development of weapon systems. The presentations were made in San Antonio, TX, at the organizations's annual banquet, to personnel of the TOW Project Office and the U.S. Army Ballistic Research Laboratories.

COL Robert Huntzinger, TOW project manager, Robert Taylor, his deputy, and Harry L. Reed Jr. of BRL, accepted the award in behalf of their organizations. Reed is chief of the BRL Concepts Analysis Laboratory.

Readily adaptable to a variety of ground and vehicle mountings, TOW is operational with the Army. It has been adopted as the primary antitank weapon for the armed forces of 12 other countries and is being considered for potential use by others.

The U.S. Army is installing airborne versions of the weapon system in the Cobra attack helicopter.

The Ballistic Research Laboratories, Aberdeen (MD) Proving Ground, were responsible for early development of three prototype missiles which established the feasibility of the TOW project.



WOLFE MEMORIAL TROPHY is hoisted by four members of the Army team that won it for development of the TOW missile system. From left are COL Robert W. Huntzinger; Robert P. Whitley, former deputy project manager; John Wlodarski, chief of the TOW Project Product Assurance Division; Robert Taylor.

Influences to Catalyze Science Careers

(Continued from page 29)

World-renowned as the inventor of the strobe light and a pioneer in the development of high-speed strobe light photography, which has produced some of the most remarkable photographs ever taken, Dr. Edgerton illustrated his address by showing many of the pictures. When he finished, students crowded around him on the stage to ask questions and chat with him.

Pine Manor Junior College. Probably one of the memories that will endure with symposium participant was their lodging and meals at Pine Manor Junior College, just off Massachusetts Turnpike about midway between Boston and Natick. Beautiful is a pallid word for properly describing the PMJC natural setting of rolling terrain, huge old trees and manicured lawns.

Known as one of the finest girls schools of its kind in the nation, PMJC is less than 10 years old. It is located on the 79-acre estate of a deceased executive of a major oil company, in the heart of one of Boston's most fashionable suburbs, Chestnut Hill in the Brookline area.

In acknowledging his appreciation to the many coworkers who collaborated with him to make the 12th NJSHS a gratifying success, Don Rollins made special reference to the "immeasurable contributions" of Dr. James Bailey of NLABS and Dr. George Newton of MIT. Dr. Bailey suggested and was instrumental in making arrangements for the PMJC accommodations.

Outstanding Students. Talks with many of the 216 students who were selected to attend the symposium deeply impressed an *Army R&D Newsmagazine* editorial staff member. Each of them had an interesting story to tell about becoming initiated into science and becoming absorbed in a research project that led to the NJSHS. Almost without exception, they acknowledged the guidance of parents or the attention of an enthusiastic science teacher.

One of the truly phenomenal success stories is that of Nicholas Brown, aged 16, who acknowledged his debt of gratitude to Dr. (Prof.) Damon Yariv of the Steele Laboratory at California Institute of Technology.

Since the summer of 1973, at the request of the California Museum of Science and Industry for his participation in the JSHS Program, Nicholas has been provided a key that permits him to work in the CIT Laser Laboratory to work weekends on his research.

Dr. Yariv, his project advisor, recommended to the parents of Nicholas and to his high school principal the he he permitted to eliminate his senior year in high school and enter the freshman year at CIT this fall, and he has been accepted for that class.

Francis Sydnor Jr., one of the five selectees to go to the International Youth Science Fortnight in London, said "I've been interested in science ever since I was nine years old when my godfather gave me a chemical set for Christmas. Still I don't know what I would have done without the assistance of Father Charles Sweeney of St. John's High School. Father Sweeney was on my back every moment, encouraging me, prodding me. I sort of procastinated a hit" (referring to his NJSHS research project).

Sydnor entered the Westinghouse Talent Search and finished in the honors group for the nation. Then, again at Father Sweeney's insistence, he entered the summer science student institute at Indiana University, which provided the basis for his NJSHS research project.

Questioned about his opinion of the NJSHS program, Sydnor responded: "Tight, extremely tight, but very good."

Etta Lovitt, a 16-year-old senior selected to go to London, skipped her sophomore year by going to summer school and working on science projects. She won the Thomas Edison Award sponsored by the Georgia Power Co. and took first place in the Georgia JSHS this spring. She has participated in the International Science and International Fair (ISEF) the past two years, and this year won the American Chemistry Society award.

Jordin Kare credits two high school teachers and a University of Pennsylvania professor for "providing inspiration" for his research project.

During 1972 he won honors in the International Science and Engineering Fair in New Orleans and participated in the National Youth Conference on Technology and Environment in Chicago. He was one of the 40 finalists in a recent Westinghouse Talent Search, winning a national merit scholarship. He said he was "very much impressed by the NJSHS program," that as a result he will revise his current work on minicomputer research, and that he plans to enter MIT computer studies this fall.

Michael Pelletier credits his father as major influence in sparking his interest in science. Michael placed third in chemistry at the 1973 ISEF and was in the honors group in the 1974 Westinghouse Talent Search. He has also won an Indiana State scholarship grant, an American Chemical Society scholarship and a professor's assistant position at Purdue University, were he plans to enroll this fall.

Susan Yohn's pathway to success in the NJSHS and the trip to London started when she received the inspiration for her research project after reading about theories relating to skin transplantations in a report by Dr. Peter Medawar. She was a top winner in her regional JSHS, took second place in the ISEF, and is programed to attend Iowa State University.

Personnel Actions...

ACC Announces Commander Retirement, Reassignment of Key General Officers

The U.S. Army Communications Command (ACC), Fort Huachuca, AZ, has announced the retirement of BG Wilburn C. Weaver, commander, ACC, Pacific and reassignment of three key general officer personnel.

BG W. C. Weaver

BG D. W. Ogden

BG D. W. Ogden Jr., former commander of ACC's Communications Systems Agency (CSA), Fort Monmouth, NJ, and ACC's Communications Electronics Engineering Installation Agency (CEEIA), Fort Huachuca, succeeds BG Weaver, backed by more than 30 years active Army service.

BG G. Grombacher

COL A. B. Shattuck

Prior to joining the ACC, BG Ogden was chief of staff of the Defense Communications Agency. Other key assignments have included commander, 12th Signal Group, Vietnam; combat development staff officer, HQ U.S. Army Combat Developments Command; commander, 127th Signal Battalion, 7th Infantry Division; and staff duty in the Office, Assistant Chief of Staff, Communications Electronics, DA, Washington, DC.

BG Ogden has a bachelor's degree in military science from the University of Maryland, a master's degree in business administration from George Washington University, and is a graduate of the Army Command and General Staff College, Armed Forces Staff College, Industrial College of the Armed Forces, and Signal Officer Advanced Course.

BG Gerd S. Grombacher, former commander of ACC's Safeguard Communications Agency, was selected to succeed BG Ogden. Initially serving in the Army as an enlisted man, BG Grombacher received his field commission in 1945 and was assigned to the Intelligence Section of the 95th Infantry Division.

Assignments in the U.S. and abroad have included executive officer, Office, Assistant Chief of Staff, Communications Electronics, DA, Washington, DC; commander, Signal Service Group 4, ACC, Europe; and chief of Operations, Office, Assistant Chief of Staff for Communications Electronics, U.S. Army, Vietnam.

BG Grombacher has a bachelor's degree in military science from the University of Maryland, and a master's degree in international affairs from George Washington University. His military schooling includes the Army Command and General Staff College, Armed Forces Staff College, Air War College, and the Infantry Officer Advanced Course.

Succeeding BG Grombacher, is *COL A. B. Shattuck,* former deputy commander, ACC's Safeguard Communications Agency. Born at the U.S. Military Academy officer's quarters, West Point, NY, COL Shattuck graduated there in 1946.

Prior to joining the ACC in 1971, he served as deputy director of Defense (Southeast Asia affairs), Research and Engineering, Office of the Secretary of Defense. In addition to assignments in Korea, England and Vietnam, he has served with the 11th Airborne Division in Japan; Office, Chief Signal Officer, DA, Washington, DC, and as a member of the Tactical Department, West Point, N.Y.

A senior Army aviator, COL Shattuck has a master's degree in electronics engineering from the University of Illinois and is a graduate of the Army Command and General Staff College.

Morris Assigned as Surface Container Systems PM

COL J. J. Morris is the new DoD project manager for Surface Container-Supported Distribution Systems Development, HQ U.S. Army Materiel Command (AMC). He succeeds COL R. A. Cramer, recently assigned as chief of staff, Military Traffic Management and Terminal Services, Falls Church, VA.

COL J. J. Morris

Until recently, COL Morris was acting chief, Procurement Support Branch, Procurement Policy Division, Requirements and Procurement Directorate, HQ AMC. During 1969–71 he served first as director of Materiel, 34th General Support Group, U.S. Army Pacific (USARPAC) Vietnam, and later as staff officer, Troop Operations and Readiness Division, Operations Directorate, Office, Deputy Chief of Staff for Operations.

Other key assignments have included commander, 58th Transportation Battalion, USARPAC, Vietnam; deputy director of Supply Operations, HQ U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO; and chief (and assistant), Training Division, Directorate of Personnel and Training, HQ AVSCOM.

COL Morris has a BS degree (summa cum laude) in business administration from St. Benedicts College, MS degrees in systems management and business administration from the University of Southern California. His military schooling includes Officers Candidate School, Army Command and General Staff College (associate course), and the Industrial College of the Armed Forces.

Among his military decorations are the Legion of Merit with two Oak Leaf Clusters (OLC), Distinguished Flying Cross, Bronze Star Medal, Meritorious Service Medal, Air Medal (10 awards), Army Commendation Medal, and Purple Heart with OLC.

King Assumes DCSPOA Responsibilities

COL Justice B. King has assumed responsibilities as deputy chief of staff for Plans, Operations and Automation (DCSPOA), U.S. Army Communications Command, Fort Huachuca, AZ, following retirement of COL R. G. Chamberlin.

COL J. B. King

Former director of Communications System and Communications Electronics Resources Management, Office, Assistant Chief of Staff for Communications Electronics, HQ, DA, COL King has a 1943 bachelor's degree in electrical engineering from Virginia Polytechnic Institute.

A former enlisted man, he received his commission upon graduating from Officers Candidate School in 1944. He served initially as a signal officer in the Philippines and Japan until his release from active service in 1946. Recalled to active duty in 1951, he served a 2-year tour in Korea prior to his return to the U.S.

Other key assignments have included Europe, Vietnam, Taiwan, two duty tours with HQ DA, and as a military instructor at numerous universities and Army schools. He is a graduate of the Army Command and General Staff College and the Army War College.

LTG Lotz Ends 30-Year Army R&D Career

More than 30 years of active Army service, mainly in key R&D assignments, ended in July with the retirement of LTG Walter Lotz Jr., deputy director since 1971 of the North Atlantic Treaty Organization's Integrated Communications System Management Agency.

Prior to his NATO appointment, coincident with elevation to 3-star rank, he had served as commander of the U.S. Army Electronics Command, Fort Monmouth, NJ.

Assigned as Director of Army Research in 1963, LTG Lotz later served as assistant chief of staff, Communications-Electronics, U.S. Military Assistance Command, Vietnam; commander, U.S. Army Strategic Communications Command (now Army Communications Command); and chief of Communications-Electronics, HQ DA.

He was graduated from the U.S. Military Academy in 1938.

New Test and Evaluation Funding Procedure to Start in FY 1975

By Austin Duncan

Deputy Secretary of Defense William P. Clements Jr. has directed that a new uniform procedure for funding tests be instituted at major DoD test activities in FY 1975.

Standardizing the financing of all tests at 18 of the 26 major test activities, the procedure will require the customer to pay direct cost only and the testing activity to pay indirect and/or overhead costs. This is a major change at some Army test activities.

Under the current system, for example, a customer of the White Sands Missile Range receives free testing (with certain exceptions); under the new system, the customer will be charged for the directly identifiable testing costs, including labor and material.

At the other extreme is the customer of the Aberdeen Proving Ground (APG) (Material Test Directorate only). This Army Industrially Funded Activity now charges the customer total costs. However, in FY 1975 APG Material Test Directorate customers will pay only direct costs, with APG paying the indirect cost from a separate institutional fund account.

Implementation of the new test and evaluation system will not increase the over-all testing costs to the government, nor will it affect the level of the RDT&E effort, since it merely changes the method of financing tests.

Establishment of the institutional funding for each of the major test activities, however, did require numerous adjustments between the Army, Air Force, and Navy. Adjustments also were necessary for the Army Procurement Appropriations, Operation and Maintenance Army, and the Army Research, Development, Test, and Evaluation appropriation. Adjustments were made during the formulation of the FY 1975 budget. All users of designated major test activities will pay only direct cost.

A user or customer is an outside party who places a work requirement on the test activity. It does not matter whether the output is T&E, research, training or any other function. It does not matter which appropriation will be used to finance the job.

Test activities providing the output must use the same rules in charging direct costs only to all jobs performed. Items that will usually be directly funded (paid for by customer) are such costs as operation of range instrumentation, data reduction, recovery/retrieval, and photographs related to tests.

Examples of indirect costs (paid by test activity) are maintenance of general-purpose instrumentation, utilities, accounting and finance, supply operations, general improvements.

The 26 major DoD Test and Evaluation Facilities are listed below. All except those identified by asterisks will be operating under the new test and evaluation funding policy effective July 1, 1974 (FY 1975).

ARMY: *Arctic Test Center, Fort Greely, AK; *Tropic Test Center, Fort Clayton, CZ; Yuma (AZ) Proving Ground; *Jefferson Proving Ground, Madison, IN; White Sands (NM) Missile Range; Kwajalein Missile Range, Marshall Islands, Trust Territory Pacific Islands; Electronics Proving Ground, Fort Huachuca, AZ; Dugway Proving Ground, Salt Lake City, UT; Aberdeen (MD) Proving Ground.

NAVY: Pacific Missile Range, Point Mugu, CA; *Atlantic Undersea T&E Center, Andros Island, Bahamas; Naval Air Test Center, Patuxent River, MD; Naval Air Propulsion Test Center, Trenton, NJ; *Naval Air Test Facility, Lakehurst, NJ; National Parachute Test Range, El Centro, CA; Naval Weapons Center (T&E portion only), China Lake, CA; *Atlantic Fleet Weapons Range, Roosevelt Roads, Puerto Rico.

AIR FORCE: Space & Missile Test Center, Vandenberg AFB, CA; Eastern Test Range, Patrick AFB, FL; *Satellite Control Facility, Sunnyvale, CA; Arnold Engineering Development Center, Tullahoma, TN; Flight Test Center, Edwards AFB, CA; Armament Development & Test Center, Eglin AFB, FL; *Air Defense Weapons Center, Tyndall AFB, FL; Special Weapons Center, Kirtland AFB, NM; and Tactical Fighter Weapons Center, Nellis AFB, NV.

The uniform funding policy will solve many of the problems faced by both the customer and the test activity. Eliminating unnecessary free testing, or the compromising of tests because of excess costs, it will encourage the user to go to the facility which gives him the best test results since the criteria for determining charges will be the same.

The total DoD community will benefit because of the improved testing, stronger test organizations, and modern test facilities.

AUSTIN L. DUNCAN, acting chief of the RDT&E Programs and Budget Division, Office of the Chief of Research, Development and Acquisition (OCRDA), has worked as a Department of Army civilian for more than 27 years, following five years with the U.S. Marine Corps in the Southeast Pacific during World War II.

Assigned to OCRD in 1958, Austin served in a number of responsible positions, primarily as chief of the Budget Team. He worked for Deputy Chief of Staff, Operations for three years, subsequent to three years with Deputy Chief of Staff, Logistics.

Duncan began his Civil Service career in 1947 with the Chief of Finance in St. Louis, MO. In 1950, he transferred to the Office, Chief of Finance in Washington, DC. He has received the Department of Army Meritorious Civilian Service Medal, among numerous other outstanding awards.

HDL Blossom Point Test Area Ends 32-Year History

Thirty-two years of weapons development history came to an end June 30 with the closing of the Army's Harry Diamond Laboratories' 2,000-acre Blossom Point Test Area in Charles County, MD.

The action is part of a consolidation and economy move by the Army Materiel Command (AMC), HDL's parent agency.

Blossom Point's functions of fuze testing, recovery testing, environmental testing and any other scrutiny of all kinds of fuzes for rockets, artillery and missiles will be relocated, July 1, to Aberdeen (MD) Proving Ground.

The 6,000-foot firing range is an archive of weapons development where unexploded portions of mortar shells dating back to World War II can be found.

Pre-Colonial history weapons development is also represented on the range; walking out from the firing area to retrieve fragments for analysis, test personnel keep their eyes peeled for Indian arrowheads. The site, a cornucopia of flora and fauna, was a gathering place for many of the North American tribes as early as 6,000 B.C.E.

Blossom Point, a peninsula thrust into the juncture of Nanjomay Creek, Port Tobacco River and the Potomac, is an idyllic preserve of the natural wonders of the Mid-Atlantic states. A herd of White-Tailed deer roam the preserve. An Army survey identified 13 endangered species of plants and 10 of animals in residence. Among the most majestic birds found are the osprey and the bald eagle.

In the center of the firing range is an ingenious device for testing the efficiency of various proximity fuze designs—a wire mesh, 65 feet by 100 feet, four feet above the ground, made of chicken wire.

Unlike their World War II precursors, modern proximity fuze shells do not use a clockwork mechanism but instead bounce a radio pulse off the ground and use a radar-like system to compute the distance.

The fuze is keyed to a particular "reflection coefficient"—the amount of the radio wave that will be reflected by the target. If a fuze is set to explode 5 feet over a target with a reflection coefficient of 0.4, such as earth, it will trick itself into exploding 30 feet over a "perfect reflector" (reflection coefficient of 1.0) such as water or wire mesh. The altitude of the explosion makes photography of the explosions considerably easier.

The cameras are mounted part way up a 300-foot tower dominating the range and the six office and shop buildings near the firing area. At the base of the tower is telemetry van, fully air-conditioned and self-sufficient, equipped with the latest in high-frequency and computer recording and measuring equipment to monitor the fuze data feed back.

The range has a sawdust recovery trough for recovering howitzer shells for scrutiny. A 40-foot tower has a steel plate at its base, making it suitable for drop-testing explosives.

Testing at Blossom Point began in March 1943, after a search for a suitable site that eventually scoured the entire Eastern Seaboard. The Blossom Point site was selected because of the flexibility and privacy it afforded. Because the moisture content of earth varies, with a direct effect on the reflection coefficient, water-target firings were needed.

The tract was originally given by Charles II of England in a grant to the Society of Jesus (Order of Jesuit priests) who own it to this day. Fuze testing was a function of the National Bureau of Standards as the tenant until 1953, when 150 NBS personnel provided the staff nucleus for establishment of the Diamond Ordnance Fuze Labs. DOFL became the Harry Diamond Labs in 1962 as part of an Army reorganization.

HIGH HOPES FOR THE FUTURE, with respect to the nation's possibility of developing scientific methods of profitable recycling of resources recovered from trash, are linked to this experimental pilot plant at the U.S. Army Natick (MA) Laboratories. Scheduled for 18 months of test operation to provide a basis for considering construction of a demonstration plant capable of processing 200,000 pounds of trash monthly, the pilot plant was conceived, designed, fabricated and installed in less than two years at a total cost of about $196,000. Standing at the control panel is Dr. John R. Nystrom, 28, NLABS project engineer who designed the system and supervised its installation. Although it is the only plant of its kind, the Soviet Union has ordered a similar system from the same U.S. firm. Nystrom speculates that the $800,000 unit may be used for experimentation to convert petroleum to single-cell proteins. Inset shows Dick Erickson, physical science technician, feeding shredded newspaper into the milling machine hopper, the first step of converting waste into glucose which may be further reduced to ethanol. *(Please turn to centerfold feature, page 16, for details.)*